JANUARY 2007 VOL 15 NO 1

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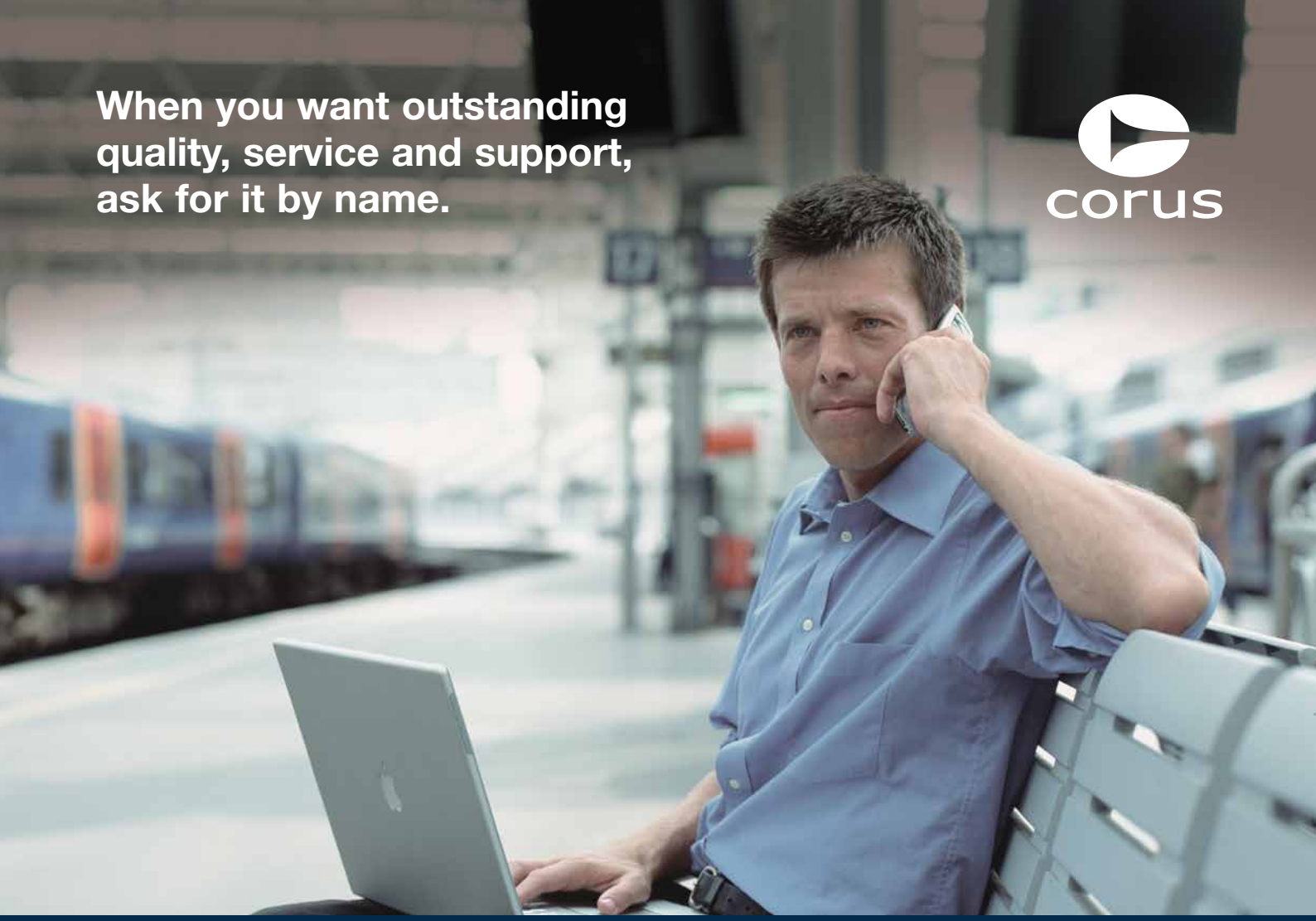

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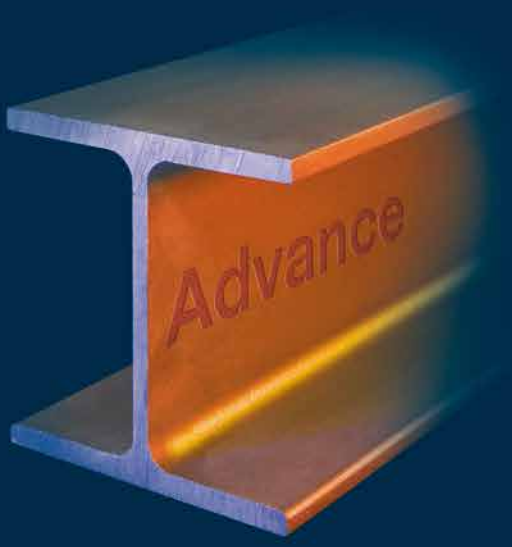


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**The things you can't see make the difference**

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**Cover Image**
**007 STAGE, PINEWOOD STUDIOS**
Client: Pinewood Studios
Architect: Foster Willis
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Steelwork Contractor: Bourne Steel

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## FEATURES













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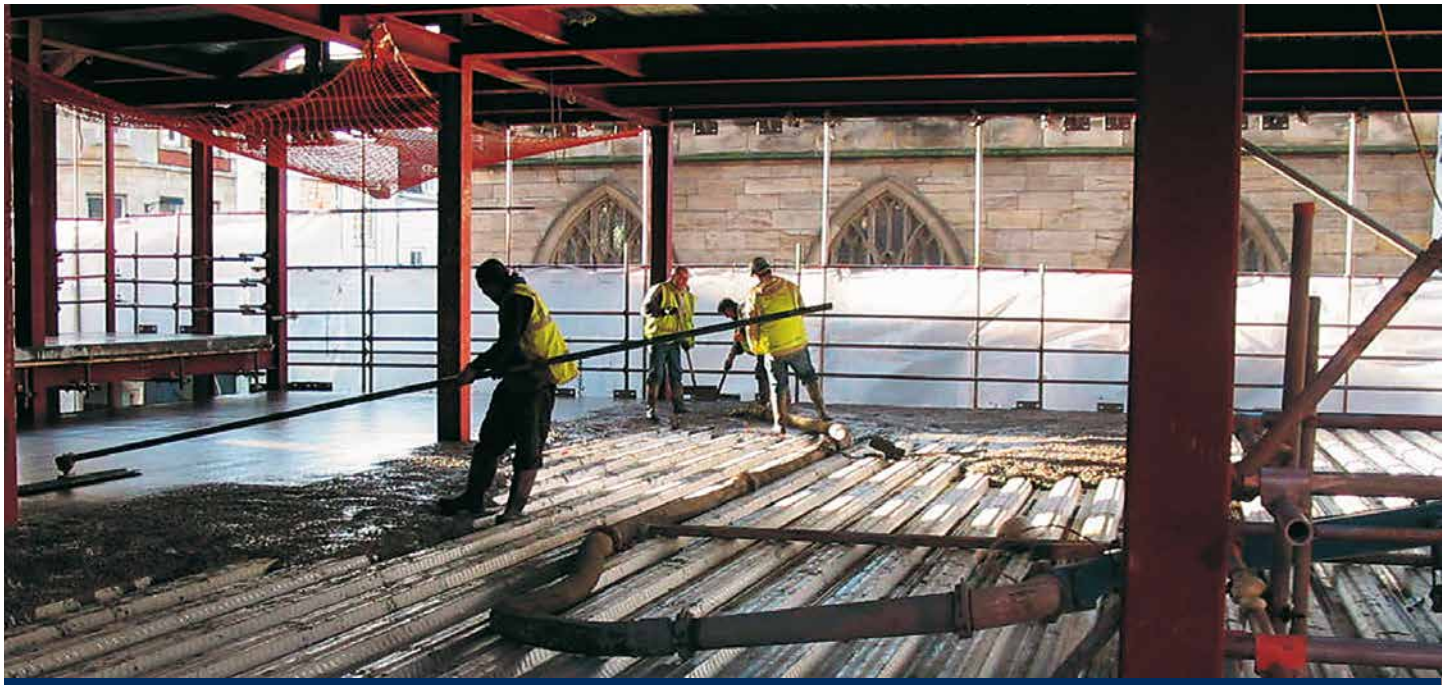

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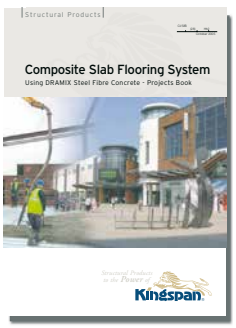


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# Ground well paved for further advance

*Nick Barrett - Editor*

The turn of the year is a good time to take stock of progress made and lessons learned for the future. The year just passed was a good one for the constructional use of steel, by any measure. Record output by BCSA's members was reported. The UK's steelwork sector remains the object of international envy, clients report delight with the cost effective, timely delivery of flexible and sustainable projects, and competitors remain on the back foot. The technical support, research and marketing back up that delivers this level of quality continues to break new ground

Highlights of the year? There are so many to choose from. Sustainability is clearly going to be increasingly important as a business driver, making it all the better that the BCSA's Sustainability Charter was successfully launched. The first steelwork contractors have already been audited and are now able to prove their sustainability credentials. BCSA also chalked up a milestone in celebrating its 100th year of successfully representing the interests of steelwork contractors, membership increasingly being regarded as essential to compete in demanding markets.

The SCI reached its 20th birthday and was able to report growing membership and a long list of new publications aimed at making steel easier to use. For example, in January NSC reported on a new design guide from SCI allowing further economies to be made in the fire safe design of buildings. There was also a revised design guide on the vibration of floors that proves how easily floors on steel framed buildings meet, and exceed, the required performance standards.

From Corus there was a major development in the launch of the new name for its range of structural sections; the range was also significantly expanded in a move that one construction weekly magazine saw as 'the biggest shake-up in structural steel manufacturing for half a century'. Independently produced Market Share and Cost Comparison surveys commissioned by Corus showed that steel still enjoys substantial cost and programme advantages over other framing solutions, and this was reflected in increasing shares of key markets.

Steelwork contractors made substantial investments to ensure that their fabrication and other production related facilities remain leading edge, delivering significant advantages to clients. The industry's safety performance remained better than the industry average and new safety initiatives are underway. The Structural Steel Design Awards showcased the best of the innovative steel designs turned into successful projects, dazzling the judges with their quality and earning high praise from key clients.

As we reached the year-end work was progressing rapidly on the extension to Corus's Medium Section Mill and new Automated Distribution Centre at Scunthorpe. Together these major investments deliver sections of higher quality than ever before, on a just-in-time basis if required.

So all in all, not a bad year of achievement. From rival framing material interests we heard nothing of any significant new developments at all, and no sign of the concrete industry investing in anything useful like fire testing of its own materials. The tactic there remains to spend money on misleading advertisements that disgrace the publications they appear in and, we can be sure, fail to influence any engineer capable of analysing the technical evidence.

The prospects for 2007 look equally promising. Nobody can accurately predict what will happen to the size of markets, but it seems reasonable to expect that steel will at least hold its own in key markets and make progress in the sectors that are being targeted for growth. There is a busy programme of research underway that will continue to issue in improved guidance and technical support for designers, all of which we will report on in NSC. Using steel is easy already, as the market tells us, and work is in hand to make it easier still. No misleading advertising will change that fact.

# Heat straightening can reduce traffic congestion

The Highways Agency (HA) in collaboration with the BCSA is now providing guidance for a recently adopted technique for bridge repairs which will help speed up such work and ultimately reduce traffic disruption.

The method, first trialled in 2000, is the use of heat straightening to repair impact damaged composite bridge beams.

"It has proven to be an economic and expeditious approach to repairing impact damage to steel bridges, and it minimises disruption for road users," commented HA Senior Structures Advisor, Safety, Standards & Research, Dr Emeka Agbasi.

"The HA is at the forefront of continuously seeking and exploiting innovative techniques to achieve our business goals of managing traffic, tackling congestion and improving safety," he added.

"Heat straightening is a potential repair method for most steel girders which have been damaged by vehicle impact and it has already been successfully used, most notably on the M20 Chatham Road bridge in Kent," said HA Head of Structures, Safety, Standards & Research, Dr Sibdas Chakrabarti.

On this project the damaged beams were returned to their original shape and some additional stiffeners were required. Dr Chakrabarti said traffic disruption was limited, as only a partial carriageway closure was needed at night.

The process involves applying controlled and patterned heating and cooling in repetitive cycles to plastically deformed regions of damaged steels, to produce a gradual straightening. It relies on internal and external restraints that produce thickening during the heating phase and in-plane contraction during the cooling phase.

However, due care and diligence is advised in the execution of the method, as pitfalls such as overheating the steel and changing its properties can occur. The HA and BCSA both advise an experienced heat straightening contractor should be engaged to conduct the work.

The technique has been used for many years in the USA and is documented in a US Federal Highways Administration (FHWA) manual, which can be obtained from the United States Department of Transport On-Line Publications Department at www.isddc.dot.gov

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or *sibdas.chakrabarti@ highways.gsi.gov.uk*
or *davidmoore@steelconstruction.org*

# New City landmark nears completion

The highly original looking One Coleman Street building in the City of London is nearing completion and will be handed over to the client this Spring.

The steel framed eight-storey building will offer 17,000m$^2$ of office space and will become the new worldwide headquarters of Legal & General.

Situated on an island site at the junction of London Wall and Moorgate, the building is ovoid in shape and clad in distinctive segmental panels.

Steelwork contractor Severfield-Reeve, working on behalf of main contractor Bovis Lend Lease, erected approximately 1,200t of steelwork over an eleven week period.

Richard Tarren, Contracts Manager for Severfield-Reeve said the unusual cladding meant the perimeter beams had the atypical slab edge profile shop fitted onto the beams to ensure that the slab edge was accurately formed.

"This was quite challenging, especially during the fabrication process," said Mr Tarren. "But ultimately, it meant the cladding went up quicker and we had a lot less cutting and positioning of metal decking and edge trim at site."

Severfield-Reeve also erected a number of architectural sloping CHS columns on the building's east elevation entrance area and a large transfer beam above the first floor level.

"The large transfer beam allowed one column to be taken out and ultimately opened up the loading bay area of the building," explained Mr Tarren.

# Steel performs in Leicester

The £48M Leicester Performing Arts Centre is set to become one of the focal points in the regeneration of the city's central district.

More than 2,500t of structural steelwork will be erected on site by William Hare, including a large 1,900t truss that supports the Centre's entire roof.

This large steel section is supported by four concrete cores and allows the building to have no internal columns. It was fabricated off site and brought and delivered in a number of separate pieces.

Scheduled for completion by late 2007, the Centre features two auditoria with seating for 350 and 750 people respectively.

The majority of the structure will be glass clad which will allow people to look in from the outside to see sets being built, and rehearsal rooms and facilities.

Main contractor is Bovis Lend Lease and the project was designed by architect Rafael Vinoly.

# Town centre jobs set to increase

*The Atrium, Camberley*

The number of high profile town centre shopping complex and regeneration projects is set to increase over the next twelve months.

Major on going projects already include the Grand Arcade in Wigan, the Westfield shopping centres in Derby and White City, London, and the Atrium in Camberley, Surrey.

Meanwhile, other schemes set to begin in the next year include, the redevelopment of Bracknell town centre, the St David's retail project in Cardiff, Farnborough town centre and an extension to the Overgate mall in Dundee.

All of the on going jobs include a significant steel element, and initial plans indicate the forthcoming projects will use structural steel.

"Steel lends itself to off-site construction and so it's widely used on town centre developments," said Scott Crawford, Structural Engineer for MPN. "On Westfield, Derby we chose to use steel instead of concrete during the planning stage, as it would not only provide us with the desired open plan areas, but it also meant less disruption to the surrounding area."

The Atrium project in Camberley is being developed by a joint venture between Crest Nicholson Regeneration and Surrey Heath Borough Council. Bruce McArthur, Project Executive for Crest Nicholson Regeneration said: "The Atrium will be an important part of the town and we required flexibility and longevity, as well as speed of construction. Steel met all of these requirements."

## SCI Dinner

Last November's SCI annual dinner was well attended by the industry as usual. Pictured is the event's head table. Left to right: Graham Owens, SCI Director; Derek Randall, Corus Commercial Director, Long Products; Professor David Nethercot; Peter Head, Arup, Head of Urban Design and Development; guest speaker, Barry Cryer; Martin Manning, Arup Director; Paul Lormor, Corus Executive Director, Long Products; Professor Patrick Dowling; Dr John Roberts, Jacobs Babtie Operating Board Director.

# Access the tool for Eurocode adoption

During November more than 3,000 practitioners from 149 different countries logged on to the SCI's Access Steel website in order to obtain critical information that will help them make the transition to the Eurocodes. Many found their way to the website via search engines such as Google or Yahoo.

By tracking live web traffic and analysing typical search words, the SCI has been able to better understand browsers' needs and their preferred web content and therefore adapt the IT tools accordingly.

Web traffic reports show that examples of construction work are the most viewed pages as they enable designers to see what steps need to be taken when designing to Eurocodes 3 and 4.

"Despite a general perception that the UK construction industry had previously shown very little concern for the Eurocodes, the tide is now turning," said Christine Roszykiewicz, SCI Project Manager.

"The Access Steel website has demonstrated that it is not disinterest or reluctance to face up to change that has deterred designers from embracing the Eurocodes for steel. Rather it is the need for practical familiarisation tools that will not put too big a burden on overhead costs," she added.

www.access-steel.com is a completely free site aimed at helping designers to adopt the Eurocodes. Produced by the six leading steel technical institutes of Europe, the information is accurate, authoritative and quality assured.

AROUND THE PRESS

***The Structural Engineer***
*7 November 2006*
**New Liverpool waterfront**
"Steel was utilised to create the seamless architectural curves," Mr Rogan said. "There is some complicated geometry involved and only steel would have worked."

***The Structural Engineer***
*7 November 2006*
**Saving time**
Construction time and costs have been significantly reduced at Warrington's Golden Square Development through the use of helical curved steel beams in the construction of the spiral car park ramps.

***Contract Journal***
*22 November 2006*
**Steel contract nears end**
Norwest Holst is nearing completion of a £1.5M contract to dismantle a heavy section steel mill for Corus at Scunthorpe. With work starting in February, 12,000t of components weighing up to 90t each will have been dismantled by the time the contract ends next month.

***Construction News***
*7 December 2006*
**Steel framed housing is the solution**
Within all sectors of the construction industry there is a greater appreciation of the quality that off-site steel frame construction can deliver.

***Construction News***
*7 December 2006*
**Sign of the times**
In the past three years there has been a huge requirement for signature bridges. Everyone seems to be launching design competitions these days. Steel gives more architectural scope for creativity.

***Building***
*8 December 2006*
**Less fire risk**
"We tend not to do multi-storey timber frame. We tend to use steel - there's less fire risk and it has better dimensional stability."

# New Eurocode for steel bridges

The BSI has issued a new Eurocode for the design of steel bridges. The code known as BS EN 1993-2: 2006 'Design of Steel Structures - Part 2 Steel Bridges' partly supersedes BS 5400-3, which according to BSI will be withdrawn in March 2010 at the latest.

Dr David Moore, BCSA Director of Engineering said members should be aware that this standard can not be used in the UK without a National Annex.

"Following publication of this Eurocode there has to be a period of two years allowed for national calibration and the development of a National Annex (NA)," explained Dr Moore.

Consequently, the NA for this new Eurocode is not due until November 2008. "But, I am aware that the Highways Agency has been working on the NA for sometime and this may bring forward the publication date," he added.

Dr Moore also advised members although there is no need to rush out to buy this standard yet, it would be prudent to develop an in-house strategy that anticipates the introduction of this latest Eurocode for bridges.

# Morrison relies on quick steel erection

Elland Steel Structures has erected more than 800t of hot and cold rolled steelwork for a new Wm Morrison Supermarkets freezer warehouse and distribution centre in Corby.

The structure consists of approximately 137,000ft$^2$ of ground floor space, with an additional 18,000ft$^2$ of offices, and an overall maximum height of 13m.

Bob Thorpe, Managing Director of Elland Steel said: "We had an eleven week lead-in period before commencing on site and then completed the steel erection in a speedy eight weeks.

"We have been associated with Morrisons for more than 20 years providing steelwork for new stores, distribution warehouses and retail outlets throughout the UK."

# Compulsory scheme will improve steelwork painting

A new national transportation infrastructure sector scheme has been published on the United Kingdom Accreditation Scheme (UKAS) web site.

The scheme (NHSS 19A) covers the quality management system requirements for corrosion protection of ferrous materials in transportation infrastructure assets using industrial coatings.

"Put simply, it applies to the painting of steelwork in structures such as bridges, stations, toll booths and interchanges,' said Dr Derek Tordoff, BCSA Director General.

"It has been designed to enhance the quality and long term performance of the coatings used to protect steel assets," added Dr Tordoff.

As the scheme has been drafted to be sector neutral it is suitable to be adopted by clients across the transportation industry and applies to new works and maintenance projects.

The Highways Agency and Network Rail are adopting the scheme as a mandatory requirement for suppliers contracted to them to undertake any painting of structure steelwork.

It includes specific requirements for contractors to achieve a skilled workforce and adopts the Industrial Coatings Applicator Training and Certification Scheme (ICATS).

Dr Tordoff said steelwork contractors and painting contractors undertaking work for clients who have adopted the scheme, should be working towards compliance to meet the implementation programme set out in the scheme's document.

"Contractors should be taking action now as they should be working towards having 40% of their corrosion protection operatives certified to the ICATS scheme by 31 July 2007 and achieving full compliance by 31 January 2008," he added.

On 27 March there will be a joint Highways Agency, BCSA, RQSC seminar on the above subject. See the diary section on page 10 for details.

# New steelwork specification

The 5th edition of the National Structural Steelwork Specification for Building (NSSS) is now available.

Published on 1 January, the revision was prompted by the development and eventual introduction of a forthcoming European standard for the fabrication and erection of structural steelwork. Known as BS EN 1090-2, this standard is widely expected to be introduced in 2008.

Dr David Moore, BCSA Director of Engineering said: "At the start it was decided not to completely adopt the philosophy of the standard, but to create a kind of halfway house between the 4th edition of the NSSS and the new European standard."

Consequently, the updated specification contains a number of changes that are relevant to specifiers and steelwork contractors.

The reference standards for steel sections, structural bolts and welding have been updated, erection tolerances for foundation supports have been aligned with the National Structural Concrete Specification and the preferred generic treatment specification has been moved from the commentary in to the NSSS.

The welding quality system standard BS EN ISO 3834-3 is now part of the NSSS and steelwork contractors are required to operate their quality systems in line with these standards.

A new section has also been added giving guidance on post-galvanised inspection to liquid metal assisted cracking. This is based on a joint BCSA and Galvanizers Association publication.

The book is available for £25 in the UK, £28 inside the EU, and £31 in the rest of the world. The price includes postage and packing.

● The 2007 BCSA diaries were printed with a preliminary draft copy of the 5th edition of the National Structural Steelwork Specification for Building Construction. They incorrectly acknowledged Chris Murgatroyd of Arup as providing further advice. Chris Murgatroyd had no formal contact with the NSSS Steering Committee and his name should not have appeared. The member of the Steering Committee from Arup is Mike Banfi.

# Gietart launch new shot blast machines

Kaltenbach has introduced a completely new and restyled range of Gietart shot blast machines.

The machines, which recently debuted at the EuroBLECH exhibition in Hanover, will eventually replace the current generation of shot blasters. The units comprise three product groups named Sprint, Marathon and Triathlon, with 14 standard model options throughout the three groups.

Simon Smith, Kaltenbach UK Sales and Marketing Director, said: "From our 20 years of very successful association with Gietart and the many UK installations benefiting from our combined expertise, this is the single most significant, shot blasting introduction. with initial customer response very positive."

Sprint models offer medium duty capacities and the Marathon units suit heavier demand and faster conveyor speeds.

Meanwhile, the Triathlon machines are designed for shot blasting steel fabrications, as well as plate, profiles and pipe up to 4m wide and 1.6m high.

# Leicester regeneration takes shape

The redevelopment of Leicester city centre is gathering pace with the city's first speculative office building nearing completion. The 50,000ft$^2$ four-storey steel-framed structure in Colton Square forms the initial phase of the much larger New Business Quarter project.

Main contractor Bowmer & Kirkland said the job involved demolition, configuring a semi-basement car park under the footprint and the provision of a transfer slab for an adjacent residential development.

Sean Clark, Contracts Manager for steelwork contractor D A Green, said working around the basement and the site's tight dimensions were very challenging.

"The building's basement was already excavated and covered by a ground floor concrete slab by the time we started steel erection," said Mr Clark. "The slab couldn't support heavy loads so we had to use lightweight electric cherry-pickers to lift steel,"

Another challenge was the fact that the building's footprint accounts for the majority of the site and consequently one mobile crane had to be permanently sited in one position throughout the erection period.

"We predominantly used one 120t capacity mobile crane for lifting steel members, which had to reach the whole site from one position," said Mr Clark.

A steel framed glass atrium will complement the office accommodation which will be completed to a Category A fit-out and billed as a business park in a city centre location.

D A Green erected 320t of structural steelwork for the project as well as metal decking and precast concrete stairs.

## NEWS IN BRIEF

Following some concerns raised in the industry media as to the **competence of steel erectors** that have slinging and signalling endorsements on their CSCS cards rather than a separate CPCS, the BCSA said steel erectors are suffering at the hands of misinformation. Peter Walker, BCSA Health & Safety Manager said many steel erectors take the 'erecting capital structures' route, which is an ECITB scheme, and this training board has far more knowledge of the steel industry and is better placed to state whether individuals are competent or not.

The **Metals Forum** has appointed John Parker, Chief Executive of the Cast Metals Federation, as its new chairman. Outgoing chairman Derek Tordoff, Director General of the BCSA, becomes one of the Forum's two Vice Chairmen.

**FICEP UK** has supplied a 1045 LBH CNC cutting line to a new warehousing facility in Warrington, Cheshire. The line has a sawing capacity at 90-degrees of 1,015mm x 450mm, at 45-degrees of 620mm x 450mm and at 60-degrees of 350mm x 350mm.

CSC has implemented **Corus Advance Section** information within its Fastrak Structural Steel Design suite, with all new CD releases incorporating the rebranded sections. Users of the software who wish to make use of the updated section information list should contact CSC at: support@cscworld.com

Simons Construction has nominated **Barrett Steel Buildings** as its Supplier of the Year for 2006. John Robertson, Associated Director of Simons said, Barrett Steel had consistently delivered a high level of quality service to a number of prestigious clients, such as B&Q and Asda.

# Environmental title goes to innovative forest walk

An unusual project to create a treetop walk using recycled steel and timber has scooped the Environmental category at the British Construction Industry Awards 2006. The 200m long walkway, constructed for the Forestry Commission, reaches 20m high and takes members of the public through the canopy of Salcey Forest in Northamptonshire.

William Haley Engineering supplied a range of footbridges using 'off the shelf' recycled steel tube lattices supporting a timber deck. The steel bridge sections of the walk way span 20m between high level steel towers constructed by Francis & Lewis International (Haley Engineering's sister company). The six towers were constructed using stiff steel tubes to form the legs and a series of cross bracing to ensure maximum stability.

The walkway was constructed during 2005 and rises from ground level at the centre of the forest through the branches to above the tree top canopy. It has also been built with future expansion in mind so that new routes can be added to the walk way at the towers.

Judges praised the "great eco-project, which has drawn crowds of enthusiastic visitors" and commented on the minimal amount of maintenance that will be required and the low impact it has had on the forest. It was also said that the project is "an idea with huge potential for the future at other locations."

Managing Director Bill Haley said: "This year is Haley Group's 20th anniversary. In this time we have built schools, hospitals, factories and supermarkets but never have we built something that has given people so much pleasure as the Salcey Forest Treetop Walkway. To receive this award too was a bonus."

# Infill walling provides fast solution

The first phase of the new £23M Caludon Castle School in Coventry has been completed with a quantity of Metsec galvanised steel framing.

Used as infill walling, it was specified because of its fast and dry installation. ISEC erected 1,150m$^2$ of 150mm and 200mm deep sections between the main structural frame of the building during a 16 week programme.

Main contractor Galliford Try said it specified Metsec's steel framing on the grounds of its build speed, all dry construction and flexible design.

Peter Farmer, Galliford Try Project Manager said: "The steel framing element of the project worked well on a complicated job where we were constructing around an already working school."

The project has been constructed in two phases, with the initial part consisting of a new three-storey crescent shaped building that is now open.

The second phase is now underway, comprising of a four-storey block and a two-storey block, which are both scheduled for completion by Spring 2007.

## Diary

*For all SCI courses, contact Sandi Gentle, email: education@steel-sci.com telephone: (01724) 405060*
*For BCSA seminars contact Gillian Mitchell, email gillian.mitchell@steelconstruction.org telephone: 020 7839 8566*

16 January
**Disproportionate Collapse and the Revised Building Regulations**
One day course. Gloucester.

24 January
**Acoustic Design in Steel**
One day course. London.

25 January – 1 March
**Steel in Construction - Evening CPD**
6 two-hour sessions on consecutive Thursday evenings.
Warrington, Birmingham and London

30 January
**Multi-Storey Steel Framed Structures**
One day course. Manchester.

7-8 February 2007
**BS 5950-1:2000 Understanding the Essential Principles**
Two day course. Edinburgh.

13 February 2007
**Acoustic Design in Steel**
One day course. Dublin

20 February 2007
**Multi-Storey Steel Framed Structures**
One day course. Southampton.

27 February 2007
**Portal Frame Solutions**
One day course. Croydon.

15 March 2007
**One day seminar on 3D Modelling for the Steel Construction Industry.**
Cost £80 + VAT (£60 + VAT to BCSA members). National Liberal Club, London

27 March 2007
**One day seminar on Corrosion Protection for Infrastructure Projects.**
A joint Highways Agency, BCSA and RQSC seminar. Cost £80 + VAT.
National Liberal Club, London

22 May 2007
**One day seminar on 3D Modelling for the Steel Construction Industry.**
Cost £80 + VAT (£60 + VAT to BCSA members). Cedar Court Hotel, Huddersfield

# Competitive gap crushes concrete

*Steel frames remain the fastest and most cost effective framing solution for both commercial offices and residential apartments according to the latest Cost Comparison Survey, reports Nick Barrett.*

Steel specifiers can have a hearty chuckle at recent concrete centre attempts to suggest that concrete can compete against steel as a choice of framing solution on either cost or programme. The latest in a 13 year series of Cost Comparison studies, and the 23 year series of market share surveys, commissioned by Corus, confirms that steel is still the preferred choice for framing for very good reasons, not the least of which is cost. 'The buildings selected for analysis in this study are typical of those actually built in the real world, which is perhaps not the case with recent copycat surveys,' says Corus General Manager Alan Todd.

The Cost Comparison survey is commissioned each year by Corus and is independently produced by a team including Arup, Mace, Davis Langdon and the Steel Construction Institute. It compares the relative costs of constructing two commercial buildings in steel and concrete, and also the relative costs for residential apartments. The conclusions reached also hold for hospitals, education and retail buildings.

The buildings designed and costed for the survey are a four storey, speculative office building in Manchester, an eight storey London head office building and an eight storey residential building in the London suburbs which includes two storeys of below ground parking and a retail ground floor.

Since the previous survey in 2005 the cost of frame and floors for the two office buildings has risen by an average of 6% for steel and 5% for concrete. Whole building costs are up on average 5% for steel and 4% for concrete. However, in absolute terms steel is still on average £33 per square metre cheaper for frame and floors than concrete and for the whole building steel is 4% cheaper, or £55 per square metre. Not surprisingly, steel also remains the fastest construction method.

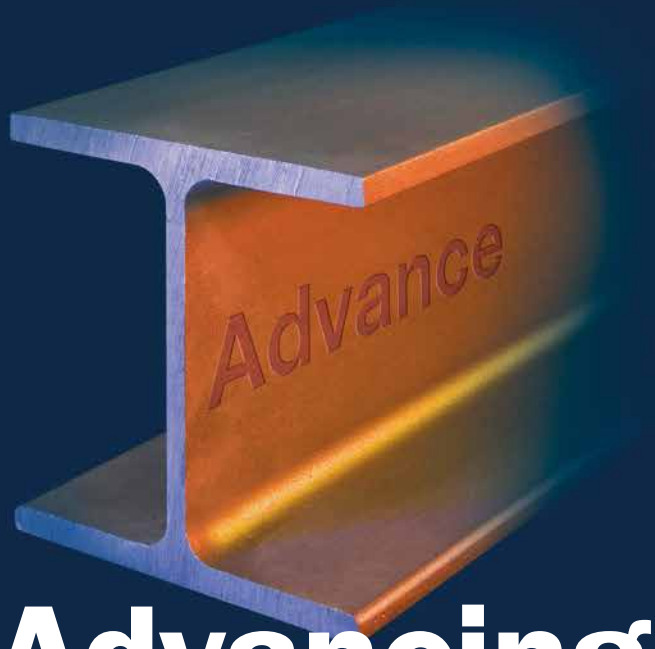
For the residential building steel sheet piling provides a basement 4% cheaper than concrete, with a 7% cost advantage on frame and floors. The overall building is 3% cheaper in steel than in concrete, even before the advantages of faster construction is factored in.

Mr Todd said: 'We can all take comfort from the fact that the survey confirms what the market already knows, that steel is well ahead of concrete even when we look only at costs. After speed is factored in, which translates into less time on site, higher quality, a safer working environment and an overall more sustainable approach to construction, steel is winning hands down, Steel also delivers predictability of project completion which is increasingly the key for many developers.'

***"We can all take comfort from the fact that the survey confirms what the market already knows, that steel is well ahead of concrete even when we only look at costs."***

Department of Trade and Industry cost indices confirm the results of the study and show steel solutions to be more competitive than ten years ago; in 2006 steel sections are still around the same price they were in 1995, in real terms. Concrete on the other hand is typically 20% more expensive in real terms today than ten years ago.

Mr Todd concluded: 'The importance of the survey is simply that it confirms what we already know, which is that thanks to the efforts of the entire UK constructional steelwork supply chain over the past 25 years we have a superb product, which continues to offer best overall value.'




# Advancing ahead

*It's four months since Corus launched the Advance branding for its beams, columns, channels, angles, and bearing piles manufactured in the UK, and many structural engineers and designers are beginning to take advantage of its benefits.*

One of the main motivations behind the introduction of the Advance brand marking was the requirement for structural sections used in Europe to comply with the Construction Products Directive (CPD).

To specify the product standard (EN 10025:2004) is no longer sufficient and CE Marking is the simplest method to show compliance with the CPD.

As sections specified by designers need to comply with the CPD, Corus has simplified the process and was the first steel producer in the world to be approved to CE mark its sections and plates as meeting the requirements of the EU directive. Walter Swann, Corus Regional Technical Manager comments: "Engineers are today faced with a great deal of change in European legislation, and many of them are concerned about possible impacts on safety and efficiency of design. The CPD, as it affects structural steel, is one of these changes, and designers take great comfort that simply specifying Advance sections from Corus can effectively make the problem disappear," he adds.

***"Designers have to consider how they can deliver the lowest cost building to their client, and lightest no longer means cheapest."***

Over the past 10 years there has been a significant change in emphasis in steel design for buildings in the commercial sector. "Gone are the days when designers could specify the lightest section and be done with it. Designers, before they put pen to paper, have to consider how they can deliver the lowest cost building to their Client, and lightest no longer means cheapest," says Mr Swann.

External cladding costs account for around 25% of the total cost of a building, compared to around 10% for the steel frame on a typical multi-story office block. The design team has to balance the costs between one element and another. Lighter beams are usually deeper which results in a taller building and higher cladding costs - invariably shallower heavier beams are the best option. "You throw pennies at the steel frame to save pounds on the cladding," comments Mr Swann.

This is where the extended range offered by Advance really has something of interest to designers. The new range has extended key serial sizes at the heavier end, and introduced three new serial ranges, one of which is a "shallow and meaty," 533 x 312 UKB series. "I'm sure this will be a huge success in the commercial and car park sectors where depth is critical, and it will allow designers to save those valuable pounds for their clients," he adds.

Mr Swann goes on to say that it doesn't stop there. "One of the new serial ranges, the 533 x 165 UKB, is perfect for the shed market, and there's already been a lot of interest shown by fabricators who are active in this sector.

The new Advance range is not just simply a re-branding exercise of a standard product. It's been carefully and thoughtfully extended to meet the demands of specific key sectors, whilst also ensuring that traditional markets are supplied with quality product," says Mr Swann.

Another important advantage of steel and Advance are the recyclability credentials. "Sustainability is increasingly important for construction and it is now at the forefront of designers' minds," says Mr Swann.

Because sustainability is a relatively new issue, many engineers feel uncertain about how best to meet the requirements. "Sourcing materials, such as Advance sections, is a big step in the right direction," Mr Swann sums up.

*Traditional markets, such as large retail developments, will be supplied with top quality product.*

# New look for Hull city centre

*The new multipurpose St Stephen's development has benefited from a number of important steel elements including more than one mile of shop front steel.*

The city of Kingston-upon-Hull has committed more than £1.5bn on a raft of new developments during the past five years. These landmark projects are set to transform and reshape the skyline, with one of the largest on-going schemes being the 40-acre St Stephen's mixed use development.

This city centre project sits adjacent to the main railway station and will comprise 30,000m² of retail, 14,000m² of leisure, 220 homes, a hotel, 1,550 car parking spaces and a new home for the locally acclaimed Hull Truck Theatre Company and the Albemarle Centre for children's music.

Scheduled to be completed by the Spring of this year, the project is anchored by a large 10,200m² Tesco supermarket which Jaime Greenock, Project Manager for Bone Steel, says is the largest steel element of the project requiring approximately 700t.

The Tesco store is basically a large single-storey warehouse erected on top of a concrete slab. "This building was erected with multi-span columns and cellform rafters," Mr Greenock says.

Although the 8.5m-high store is linked to an adjacent mall, it is an independent structure designed to incorporate large open plan areas. The building has a footprint of 120m x 84m and consists of 20 bays, each 6m deep.

Stuart Hinde, Director at Hinde Carville Design (Bone Steel's design engineers) explains: "Alternate 'hit and miss' internal columns give the client the required open plan store, resulting in 16.5m long cellbeam rafters on a 6m x 16.5m grid, and 12m long spine beams."

However, what has made the Tesco store interesting, for those involved, is the 1,500m² mezzanine level.

"Originally a mezzanine level was in the client's plans, but we were later instructed to omit it," Mr Hinde says. "However, in anticipation of it's reinstatement, we designed the building to work with or without the mezzanine. It has since been reinstated."

***"In anticipation of its reinstatement, we designed the building to work either with or without the mezzanine."***

Mr Greenock agrees and says: "All columns, external and internal, are capable of taking the extra floor level." By adding the mezzanine level, Bone Steel will supply another 200t of structural steelwork and approximately 1,500m² of decking.

However, reinstating the mezzanine level at a relatively late stage means the erection process will be a little challenging. The Tesco store is nearly complete, including the roof. Adding another floor level inside a finished building means doing the erection without the aid of any cranes.

"There's no room inside for even a small mobile crane and the concrete slab probably wouldn't take the weight," Mr Greenock says. "We''ll be using telehandlers to bring the steel into the structure and to do most of the steel erection."

The entire project is centred around a curved 200m-long mall, covered by the development's signature steel wave-like roof. With the Tesco store situated at one end, there are retail outlets of differing sizes arranged along the mall on two levels. Although both sides of the mall are essentially concrete structures, there is some significant steelwork.

A large steel roof covers the retail and cinema complex, which is situated on the mall's southern elevation. Constructed on top of concrete columns,

the roof covers an area of some 10,000m². Mr Hinde says, a lightweight steel roof for this concrete structure was always planned as it offers a quick and cost effective solution.

Large open areas were important in the retail outlets and cinema complex, so cellbeams were predominantly used with some spanning up to 30m.

"As the roof follows the curvature of the mall, most of the grids are different and this proved challenging in the design stage," explains Mr Hinde. "We also used cellbeams where necessary, instead of trusses, as this was more cost effective."

"Erecting this roof meant we were continually punching off concrete," says Mr Greenock. "Some of the concrete columns were cast with bolts which allowed the steel members to be easily installed, and on the perimeter columns there were cast in plates and we welded the beams to their fins," he adds.

The roof also supports the adjacent signature roof over the mall. "We had to take the extra loading into account and use a robust bracing system," says Mr Hinde.

Beneath the roof along the mall itself, Mr Greenock estimates Bone Steel will eventually supply and erect more than one mile of shop front steelwork and perimeter louvre steel around the outside of the Tesco store. "Much of this is dummy steelwork, covering up the concrete columns," says Mr Greenock. "Aesthetically, steel looks better than concrete."

More than 400t of steel is being used for the eight level hotel which is being constructed on top of the development's concrete car park. Mr Greenock explains the decision to use steel for this part of the project. " A steel-framed structure is lighter and also quicker to erect," he says.

To the north side of the hotel stands the Albemarle theatre building which Mr Greenock says has been the most challenging aspect of the whole project.

The steel-framed theatre consists of a main rectangular three-storey block with an elliptically-shaped music centre building attached to the front. "The music centre is oval and needed 14 skewed columns as its frame," says Mr Greenock. "They couldn't be conventionally bolted down using base plates because they'd just fall over, so we had to tie them together with cross members using a frame."

Bone Steel had to pre-assemble the steel frame on site and then build this frame into another frame. This then created the oval shape and the gaps were filled in with beams.

"The structure had to be supported until the first concrete floor was poured," says Mr Greenock. "Up to this point it wasn't stable."

The oval-shaped music centre has a footprint of 150m² and columns used ranged from 254 x 254 x 76 to 356 x 368 x 129 UKCs

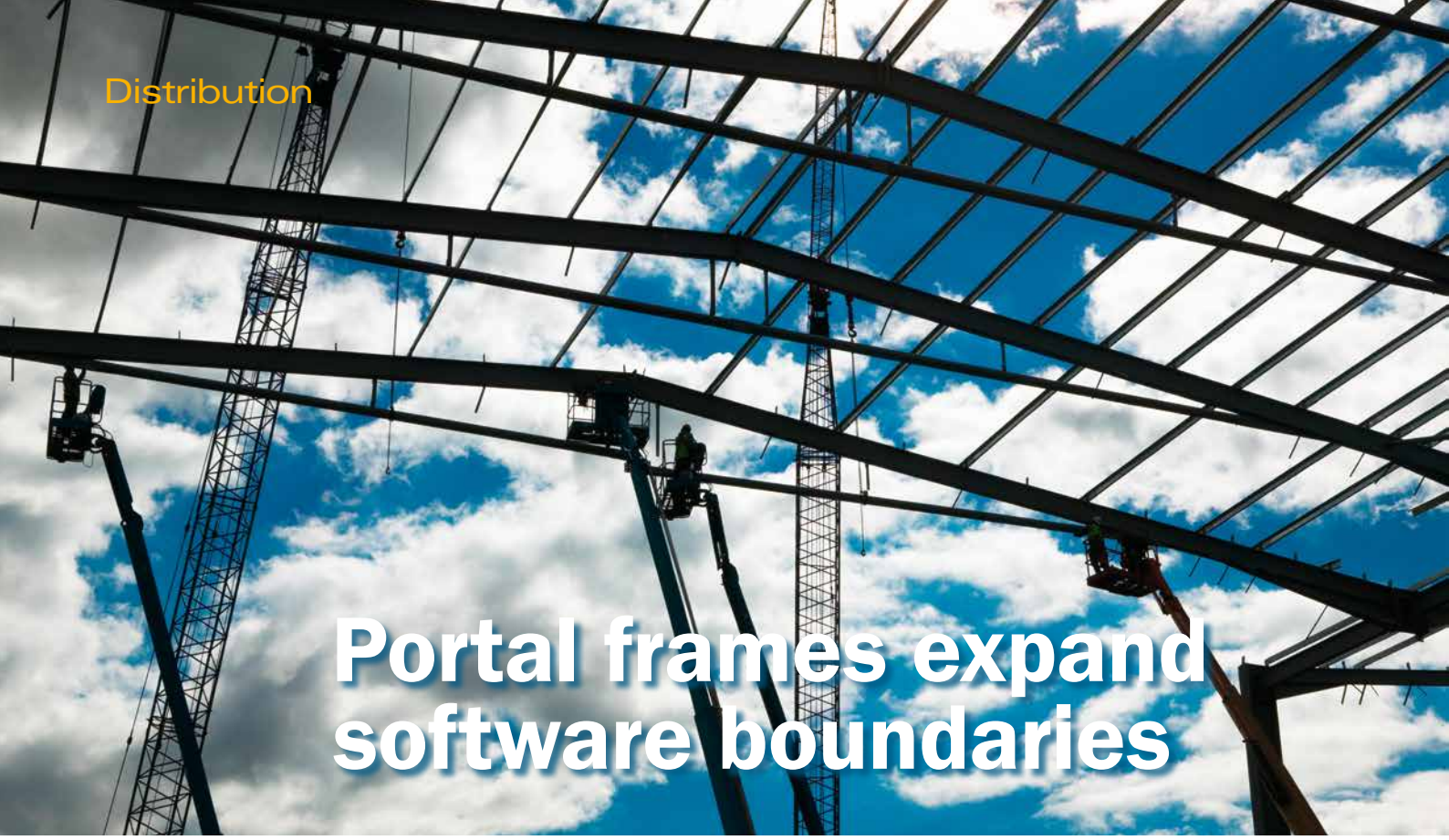
For logistical reasons the oval-shaped structure was erected first and then the rectangular block was built around it.

Mr Hinde says the music centre structure lent itself to steel design. "It looks a little like a tee-pee. The geometry was again challenging, with both elliptical and radial curves to floor plans as well as a reducing footprint as you move up through the structure," he adds.

*Above, previous page: The retail roof supports the mall's signature roof. Above left: All of the Tesco store's columns can take extra loading. Above: Fourteen skewed columns support the music centre.*

*Below: The project covers a vast previously derelict site adjacent to the city's main railway station.*

***FACT FILE***
***St Stephen's development, Hull***
***Main client:*** *ING Real Estate Development*
***Architect:*** *Holder Mathias*
***Structural engineer:*** *White Young Green + Hinde Carville Design*
***Main contractor:*** *HBG Construction*
***Steelwork contractor:*** *Bone Steel*
***Project value:*** *£200M*
***Steel tonnage:*** *1,700t*



# Portal frames expand software boundaries

*Designing one of the UK's largest ever distribution centres required some close cooperation between Atlas Ward and its software provider.*

**FACT FILE**
**Distribution Centre, Swinton, South Yorkshire**
**Architect:** *RPS Burks Green*
**Structural engineer:** *RPS Burks Green*
**Main contractor:** *Bowmer & Kirkland*
**Steelwork contractor:** *Atlas Ward Structures*
**Project value:** *£53.5M*
**Steel tonnage:** *6,150t*

*Above: The two warehouses represent the first phase of construction at Brookfields Park.*

Two adjacent portal frame warehouses with a combined floor area of more than 1million/ft² represent the UK's largest single site distribution centre, and one of the largest currently under construction in Europe.

Situated on Brookfields Park - a large new commercial development on the outskirts of Swinton, South Yorkshire - the two warehouses have both been let to a single customer and will be used as a distribution centre for household fabrics and clothes.

"This is by far the biggest steel erection job we've done in the last year," Andrew Bramley, Atlas Ward Project Manager, explains. "We'll eventually erect more than 6,000t of hot and cold rolled steel on the site."

***"This is by far the biggest steel erection job we have done in the last year"***

Working in conjunction with main contractor Bowmer & Kirkland, Atlas Ward began steel erection in June and finished the majority of its work in October. Fit out of the two warehouses also began in October with the client scheduled to move-in in March.

Justin Watts, Bowmer & Kirkland Project Manager said: "The warehouses have footprints of 410,000ft² and 710,000ft² respectively. Both have maximum 21m clear haunch heights with the smaller unit consisting of six spans, and the larger building consisting of 10 spans.

Warehouses of this size are uncommon, and consequently during the design stage Atlas Ward stretched the capability of CSC's Fastrak Portal Frame Design software to facilitate the design procedures required.

Ian Bell, Atlas Ward Structural Design Coordinator for the project, says: "Atlas Ward appreciated the technical software support that was provided by CSC in order to ensure that we were able to provide a cost effective and efficient design for the 10 span portal frame structure."

Another challenging aspect of the design work was the large mezzanine floor area in the larger warehouse. This unit has an overall footprint of 300m x 220m, with the mezzanine level measuring 300m x 70m.

Mr Bell explains: "The mezzanine level was designed as a free-standing structure supporting heavy imposed loads (up to 20kN/m²), with the rest of this area of the warehouse, a 300m wide x 16m high portal frame, sitting on top of it."

More than 1,300t of structural steelwork was used for the mezzanine level which sits 5m above the warehouse floor level. Above this level Atlas Ward had to support provision for an upper proprietary floor system. This floor system does not form part of Atlas Ward's contract, but the floor columns supporting the heavy mezzanine are extended to the upper level and designed to support the upper level grillage.

As well as storage space, both warehouses contain office blocks. Inside the larger unit there is a 50m-long x 12m wide two-level office, while in the other there is another two-level block measuring 13m wide x 54m long.

Because the buildings are distribution centres both required large open plan areas. Consequently, the bigger structure has nine 28.6m spans and a single 43m span, and the smaller unit has five equal spans of 33m and one span of 38m. Both have alternate internal columns on the valley lines removed.

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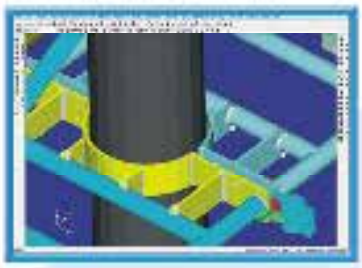

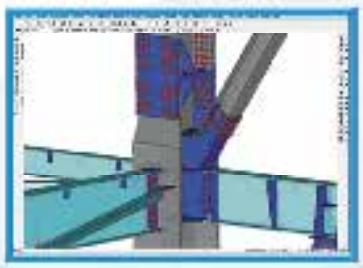

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# Deep piles take the weight for new Corus facility

*The new Automated Distribution Centre now under construction for Corus at its Scunthorpe works required an extremely rigid structure to guarantee its successful operation. The use of steel bearing piles ensured that the foundations were up to the task.*

Imagine a giant IKEA type racking system, but instead of bamboo furniture it is holding bundles of heavy steel sections on 24 levels of supports until an automated crane system plucks the bundles off and takes them away and loads them onto trucks or rail. That gives you some idea of the massive new Automated Distribution Centre (ADC) now under construction for Corus at its Scunthorpe works.

"It's not a building, it's more like a giant machine," says Corus Senior Project Engineer Ian Clayton.

"The whole structure has been designed around the need for very tight tolerances which will allow the building's automated stacking system to pick up and set down bundles of steel which will weigh up to 6t," explains Mr Clayton.

***"It's not a building, it's more like a giant machine."***

Paul Saddington, Corus ADC Project Manager, says: "When open Scunthorpe's Automated Distribution Centre will be able to store up to 17,000t of steel sections completely under cover and protected from the elements.

*Above: Two rigs installed 316 piles for the ADC's foundations.*
*Left: Billington Structures supplied and erected all of the steelwork for the ADC.*

**"We have nearly as much steel under the structure as in the building's main frame."**

*Right: The ADC will ensure all stock is stored under cover.*
*Below: Each pile has a steel plate and a concrete pile cap with bolts to accept a column.*

The new facility will not only enhance Corus Construction and Industrial's end product quality for sections, but it will also minimize handling-time and increase load flexibility, while also improving safety standards. All these factors together will ensure that all products are dispatched on time in the best possible condition".

The ADC is a very substantial building, housed within a steel-framed warehouse, which measures 159m in length, has a width of 25.7m and is just over 30m high.

The building has four aisles running the length of the structure and each of these lanes comprises 24 different levels for storing stock. An extremely rigid structure had to be guaranteed as the facility is being built to exacting tolerances to cope with the need to support the stock contained within it and enable the computerised cranes to function correctly.

In addition the infinite array of possible load combinations, meant that a foundation solution had to be found which could ultimately guarantee the required rigidity of the structure above ground.

"We originally thought about a concrete raft for the foundations, but after surveying the site we knew it couldn't adequately support the building," explains Mr. Clayton. "We needed extremely rigid foundations without the risk of differential settlement and so the only solution was piling." The new ADC was built on a backfilled area adjacent to the existing Medium Section Mill where no building work had previously been undertaken, as it had been used as an open storage area.

A site investigation indicated underlying limestone at 22m on which it was intended to found the piles to achieve their initial designed working loads of 2000 KN.

"It was at this point we chose to use steel bearing piles for the project," says Mr Saddington. "Driven steel piles are best in these conditions, they're quicker and there's no resulting spoil to deal with using this method," he explains.

The civil engineering contractor for the project was Clugston and its work included the piling as well as installing the concrete slab.

"The required capacity was an important driver in the whole construction process," says Neil Webster, Clugston's Site Manager. "So a total of 316 piles were driven, one for each of the ADC structure's columns. Consequently we have nearly as much steel under the structure as in the building's main frame."

Beginning in February, the entire piling operation was completed in a 14-week programme by two piling rigs. All the piles were Corus Advance 305 x 305 x 186 UKBP units manufactured at Corus' Teesside Beam Mill and were installed on 3m by 6m grid to match the column spacing of the ADC. The 305 x 305 x 186 UKBP was selected at it is a very 'driveable' pile and also gives a high load capacity.

The likelihood of finding obstructions was also deemed to be quite high as the piles were being driven through backfilled material that was made up largely of unknown material and clay. "Using steel piles meant that if we encountered any obstructions during driving, the pile wouldn't be damaged. Hitting obstructions with a pre-cast concrete pile could have resulted in cracking below ground level which may have gone unnoticed until it was load tested when replacement would be difficult." says Mr Webster.

As the superstructure design progressed, the loads on individual piles increased from 2000 KN to 2500 KN. To meet the tight construction programme, pile installation was already in progress and it was found that to achieve the required set for the higher load, the piles had to be founded at a depth of 28m on ironstone rather than the limestone at 22m. Once again, the decision to use steel bearing piles proved to be advantageous as it meant that this last minute change could be accommodated by simply extending the piles.

The piles were designed to be installed in one 10m-long length, with a second 15m-long section welded on and then driven into the ground. "Fortunately, steel bearing piles lend themselves to extension, so welding on a third section wasn't a major problem," says Mr Webster.

Once the piles had been installed each one had a steel plate welded to the top, followed by a concrete pile cap with holding down bolts cast in to accept the steel columns. All of this was done as the surrounding concrete slab was cast and once this was complete all the bolts were individually surveyed to ensure their exact positioning before being grouted into place.

"This ensured that the columns were going up in the right position and it also made the subsequent erection of the main steel frame much quicker," says Mr Clayton. "All the steelwork contractor had to do was bolt on the columns in the full knowledge that the positioning had all been taken care of."

# Steel regeneration for old mine

*Redeveloping brownfield sites is now an important sector as many former industrial areas are opened up for new business. In South Yorkshire a new distribution centre has been erected on a former open cast coal mine and will bring new employment to the area.*

*Above: The new distribution centre is located on the site of the former Houghton Main Coal Mine*

South Yorkshire was once one of the main coal mining regions of the UK. The sector employed thousands of people and provided the fuel for most of the other major local industries such as steel, textiles and heavy engineering.

Today, the majority of the mines have been decommissioned leaving behind large tracts of land ready for redevelopment. One of the largest of these brownfield sites is located at Houghton Main, near Barnsley, where a speculative 49,025m$^2$ distribution centre has recently been completed.

ProLogis bought the 36-acre prime site in October 2005, after Harworth Estates - a division of UK Coal - closed the colliery and reclaimed the land for employment use.

Buckingham Group Contracting, working on behalf of ProLogis, has constructed the cross-dock facility which has 84 docks, a two-storey external office block, a small internal hub office and easy access to both the M1 and M18 motorways.

However, before work on the structure could begin some thorough ground improvements had to undertaken. Rob Miller, Buckingham's Contracts Director explains: "The former open cast mine was backfilled and remedial work had been completed before we came on site. But in places the backfilling was 30m deep and there was a possibility of long term settlement."

The company consequently employed dynamic compaction over the area to a depth of 6m. "This gave us a stiffened raft of material on which to build the warehouse," Mr Miller explains.

Once the site had been sufficiently compacted Buckingham then constructed the concrete base and steel work was able to start in May.

The warehouse measures 321m x 145m, and consists of four 36m spans with 40 eight metre wide bays.

***"We split the entire process into four phases and completed the job in a speedy eight weeks."***

Grenville Griffiths, Caunton's Project Director says the main challenge with this project and any job of this size, is always delivering the steelwork on time as well as completing the erection within the programme.

"All of this we did," says Mr Griffiths. "We split the entire process into four phases and completed the job in a speedy eight weeks."

To allow for the large spans, Caunton used 610mm x 229mm beams as rafters throughout, while internal and external columns are predominantly 762mm x 267mm beams.

The warehouse also features cantilevered eaves detail with bullnose flashing and feature CHS bracing to the elevations. While at the unit's two goods entrances there are also CHS columns acting as supports to building's brise soleil sunshade louvre blades.

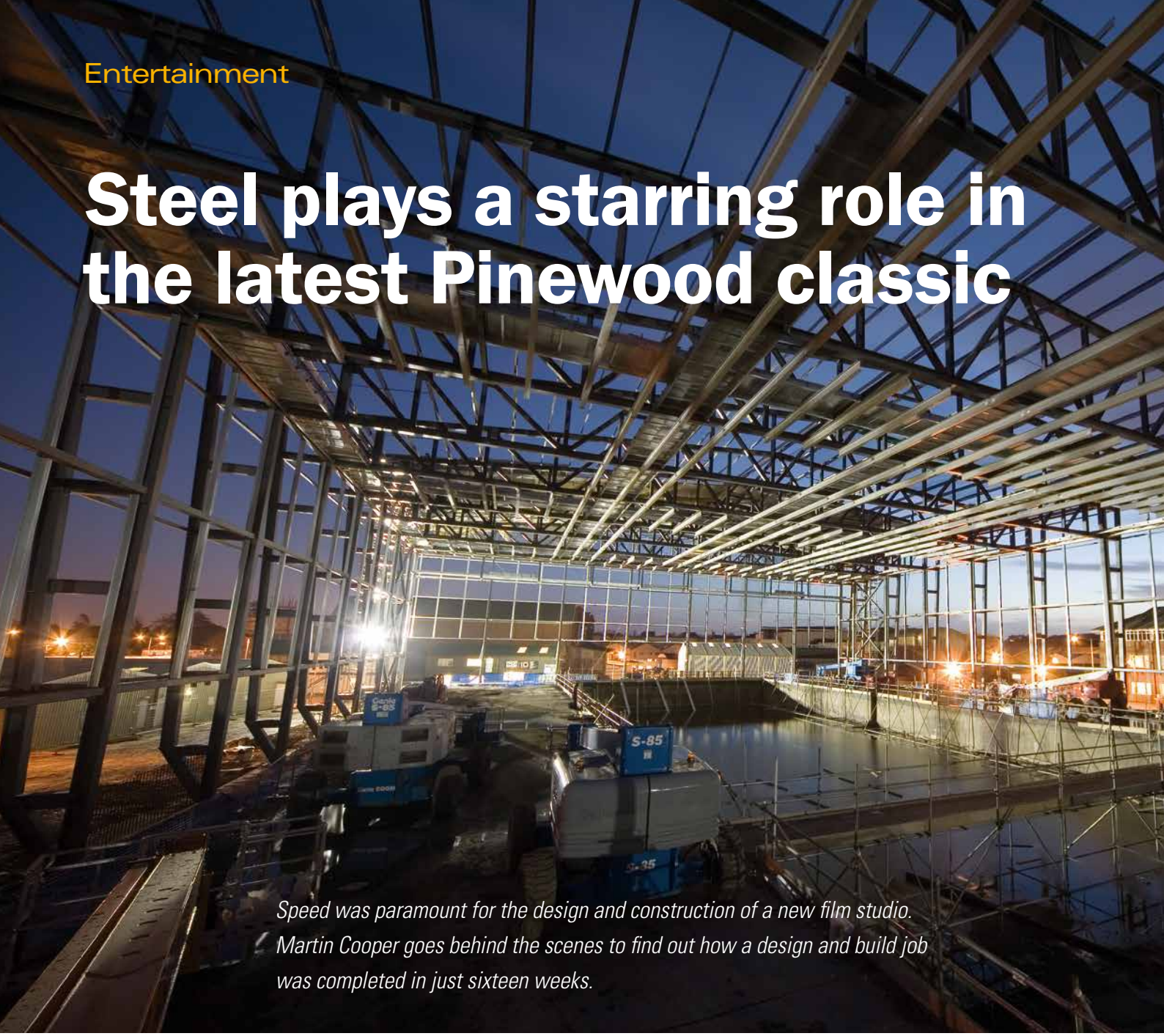
Buckingham completed its work at the end of November, and the speculatively built warehouse is now ready for use.

Commenting on the project, Leader of Barnsley Council Stephen Houghton CBE says: "We are delighted that ProLogis chose to make this significant investment in Barnsley and welcome the local jobs this development will create."

***FACT FILE***
***ProLogis Park, Barnsley***
***Main client:*** *ProLogis Developments*
***Architect:*** *Alan Johnson Associates*
***Structural engineer:*** *RPS Burks Green*
***Main contractor:*** *Buckingham Group Contracting*
***Steelwork contractor:*** *Caunton Engineering*
***Steel tonnage:*** *1,700t*

*Above and below: Under the structure's concrete slab the earth needed to be dynamically compacted to provide sufficient rigidity.*

# Steel plays a starring role in the latest Pinewood classic



*Speed was paramount for the design and construction of a new film studio. Martin Cooper goes behind the scenes to find out how a design and build job was completed in just sixteen weeks.*

***FACT FILE***
***Pinewood Studios 007 Stage, Buckinghamshire***
***Main client:*** *Pinewood Studios*
***Architect:*** *Foster Willis*
***Structural engineer:*** *Adams Kara Taylor & Bourne Engineering*
***Main contractor:*** *Bluestone*
***Steelwork contractor:*** *Bourne Steel*
***Steel tonnage:*** *1,450t*

Designing and constructing steel structures can sometimes be a complex and time consuming process. But a new film studio at Pinewood has recently highlighted the speed with which a design and build contract can be completed with the use of steel and off-site assemble.

Last July's well publicised fire which destroyed Pinewood Studios' Albert R. Broccoli stage, where filming of the latest James Bond movie, Casino Royale, had just finished, left the facility in urgent need of a replacement building.

Pinewood needed the new studio to be rebuilt and functional as quickly as possible because filming is due to begin early this year for the next Bond movie.

Alan Pillinger, Bourne Engineering Managing Director says his company was contracted to a 16 week programme, which basically left his team with eight weeks to complete the steel-framed structural design, 3D modelling and then download all of the information.

"A condensed time-scale for the size of project," says Mr Pillinger. "But the client knew from the beginning the constraints we were under and they allowed us to fix the geometry of the structure quickly, which helped enormously," he adds.

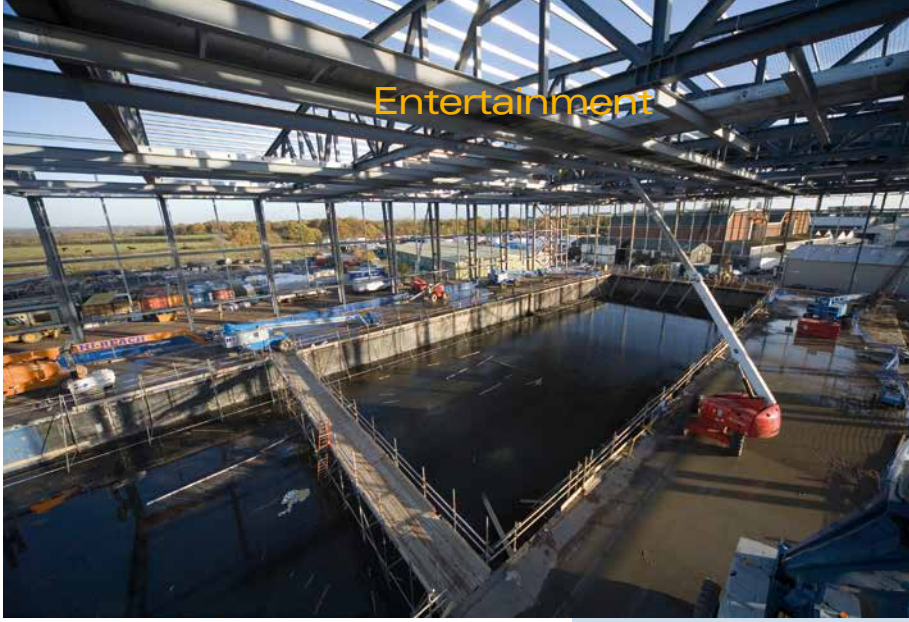
Bourne Engineering came up with a design for the new studio, which more or less covered the same footprint as the old building. "Our scheme was taken on-board by the client without any tweaking, as this would have added time and eaten into the programme," adds Mr Pillinger.

Once the design was approved, sister company Bourne Steel was also able to fabricate approximately 20% of the steelwork within the initial eight weeks.

As the new structure sits on the previous building's footprint, main contractor Bluestone says it had minimal ground preparation to do before steelwork erection began. However, a site survey ruled out reusing the old foundations and consequently new column bases were needed.

"The new columns are founded midway between the old columns' bases, so the new grid pattern is off-set by half a grid," explains Mr Pillinger.

Nick Flexen-Cook, Bourne Steel Divisional Manager says this increased the length and width of the structure by about 5m. "Because of existing build-



*Left: The building covers the world's largest indoor water tanks.*

*Above: Under the long span trusses a beam grillage will support scenery and equipment.*

*Below: A total of 16 52m-long trusses have been lifted into position.*

*Photos: Robby Whitfield, Central Photography*

ings on two sides, the new structure was slightly constrained as to how much larger it could be," he says. "And, importantly, the whole building just has to cover the water tanks."

The tanks, Mr Flexen-Cook is referring to just happen to be the world's largest indoor water tanks, with a capacity of more than one million gallons. They were initially constructed for the 1977 Bond movie, 'The Spy Who Loved Me' and have since been used for major water scenes in most of the subsequent spy movie series.

***The tanks just happen to be the world's largest indoor water tanks with a capacity of more than one million gallons***

The new building has a length of 102m, a width of 48m and is 19.2m high. This covers the main water tank, while a smaller interconnected tank is subsequently covered by a 28m x 15m lean-to structure.

"Inside the new building there is a 9m wide concrete apron around the tanks, on to which we were able to position our smaller cranes and cherry-pickers," explains Mr Flexen-Cook. "Otherwise, the building's floor will pretty much all be water and some very long spans, as no internal columns could be installed, were required."

To support the roof and accommodate the 48m spans Bourne Engineering designed a series of 16 trusses. These large elements are 52.88m long, 4.3m deep in mid-section and 3m deep at the eaves. A further two smaller trusses, measuring 28m in length, have also been erected in the lean-to.

Each truss was brought to site in three separate pieces and assembled next the building. "We designed a set of trestles we dubbed "toast racks" into which we inserted the sections to enable them to be bolted together," explains Mr Flexen-Cook. Once assembled the trusses each weighed 28t and required Bourne to bring a 400t capacity mobile crane onto site to lift them into position.

As well as spanning the water tank, the trusses also form another integral element of the building. Underslung from the bottom boom of each truss there is an interlinking grillage of runway beams - 405 in total - which have a global loading of 2.5kN/m$^2$.

"This is an equivalent loading to a multi-storey carpark," explains Mr Pillinger. "The structure is therefore very rigid and the grillage will allow the film makers to hoist and hang scenery and equipment from trusses," he adds.

The trusses also incorporate and support a network of maintenance pedestrian walkways, five running the length of the building and a further three spanning the width.

Another important part in achieving the 16 week programme was to fabricate and pre-assemble as much of the steelwork off-site in order to save valuable time. A prime example of this are the four internal staircases leading to the maintenance walkways.

These bespoke modular units were each delivered to site, by sister company Bourne Off-Site Solutions (BOSS), in five segments and then simply bolted together.

"This helped with the overall speed of the project," says Mr Pillinger. "By installing modular units meant the staircases already came complete with linings and fire cladding, which negated having to employ other trades."

The studio is due for completion this month, ending a successful programme which has seen a 3D model evolve into a finished structural frame in just 16 weeks. Despite all the fancy gadgetry at Q's disposal, even he would have been impressed with that.

# Building bridges for east London

*A total of ten new steel bridges have been erected as part of the northern extension to the East London Railway. Martin Cooper walks the line from Shoreditch to Dalston.*

The tenth and final new bridge for the northern extension of the East London Railway was lifted into position during a four week period last Autumn.

The 350t, 48m-long structure spanning the Regent's Canal, more or less brought to an end a nine month erection process which also included refurbishing a further 11 bridges on the line.

Part of a £900M scheme to extend the existing railway, the project will act as a catalyst for regeneration and will ease over-crowding on other rail and underground lines. Phase one of the project, will extend services north from Shoreditch to Dalston Junction and south from New Cross to Crystal Palace and West Croydon, with an operational railway being delivered by 2010.

The bridge replacement and refurbishment work, which was completed in December, is all part of a £35M enabling works package awarded to Taylor Woodrow Construction in June 2005 by Transport for London. Balfour Beatty is due to begin the main works this month (January).

Taylor Woodrow's work mainly involved the northern extension and included preparing the line north from the Bishopsgate Goods Yard - where the new Shoreditch High Street Station will be built - to Dalston.

This northern section makes use of redundant lines and infrastructure once used by trains originating from the now closed Broad Street Station. Much of the new line will run along the 2.5km-long Kingsland Viaduct which is parallel to the A10. It is along the viaduct that all of the bridge replacement work has been carried out in conjunction with steelwork contractor Rowecord Engineering.

Mark Howard, Project Manager for Taylor Woodrow says it is a testament to the Victorian engineers that so much of the viaduct is still in good condition. "Apart from sections of strengthening, some brick replacement work and re-pointing, a lot of the structure is sound," he says.

***It is a testament to the Victorian engineers that so much of the viaduct is still in good condition.***

As for the viaduct's bridges, it was decided, after a thorough site inspection, that 11 bridges would remain in place and undergo refurbishment - includ-

*Right: A second extension has been proposed from Dalston to Highbury & Islington*

*Below: New bridges underwent a trial erection at Rowecord's factory.*



*Far left: The arches being lifted into position on the Regent's Canal bridge. Left: One of the 30m-long main girders gets positioned.*

***FACT FILE***
***East London Railway enabling works***
***Main client:*** *Transport for London*
***Structural engineer:*** *Faber Maunsell*
***Main contractor:*** *Taylor Woodrow Construction*
***Steelwork contractor:*** *Rowecord Engineering*
***Steel tonnage:*** *1,300t*


ing the Kingsland Bridge over the A10 - with the rest being demolished and replaced with new structures.

However, prior to Rowecord erecting any of the ten new bridges, some major logistical planning had to be undertaken. Wayne Powlesland, Project Manager for Rowecord, explains: "The streets around this part of London, especially either side of the viaduct, are very narrow and busy. So getting materials and plant equipment on site was very challenging and had to be planned well in advance."

All steel was delivered at night, to avoid the heaviest traffic, and Rowecord looked at, and planned the best possible routes into London. There are almost 170 arches along the viaduct and 75% of these are rented by small businesses. "This was something we had to take into account during bridge erections," Mr Howard says. "We had to ensure access was not obstructed by our cranes or materials and these businesses remained fully functional, which was difficult in some narrow streets," he adds.

The two largest new bridges on the extension were also the most challenging, says Mr Howard. Towards the southern end of the viaduct, a bridge known as Union Walk Two required the largest individual sections and the erection was also compounded by the very tight and congested site.

"This bridge and the Regent's Canal crossing were the most difficult," Mr Howard adds. "However, we were lucky with the Union Walk Two structure as an adjacent building had just been demolished. We came to an arrangement with the landlord and this gave us extra space for the steel erection and storage."

"The narrow alleys around Union Walk were too small to accommodate a mobile crane and consequently we had to position an 800t capacity crane 40m away from the site to get the needed radius," Mr Powlesland explains.

The Union Walk Two bridge is heavily skewed and connects at either end with refurbished bridges. The structure consequently required two off-set 21m-long plate girders, 27m-long abutment trimmer cross beams with welded doubler plates on the top and bottom, while the deck was constructed with 358mm x 406mm x 340mm sections.

Meanwhile, almost halfway along the viaduct's length the line crosses the Regent's Canal. Here the extension's largest new structure was erected, a 48m-long steel tied arch bridge with plate girder tie beam suspended from arches by RHS's at equidistant points.

George Lawlor, Associate Director for Faber Maunsell says he believes this to be the first tied arch bridge ever used on a heavy railway. "The client and local planning authority wanted a signature bridge and this design best suited their requirements."

"There's no particular reason why it has never been used for rail before, but tied arches have become popular with road applications and they're certainly in vogue," he adds.

Rowecord fabricated the bridge in 51 separate sections and erected it in a four week programme. The main span is 30m long and then spliced sections at either end extend the bridge to its overall length. The structure is 10m high and 13m wide with a slight skew to give the correct rail alignment.

The original bridge was demolished in 2005 apart from its cast iron centre piers which were recently removed to storage. In order to accommodate the new structure's extra loading, some major piling work needed to be carried on the abutments.

"We had to liaise closely with British Waterways during the erection process," Mr Howard explains. "The canal had to remain open so we adopted a stop-go method of construction and every time a steel member was lifted we had marshalls on the canal banks stopping any barges."

Rowecord also supplied and erected another eight bridges along the viaduct. Starting at the northern end, Middleton Road is a 17.4m long structure consisting of two plate girders and 7 x 9.5m wide cross members. The structure also included two collision beams and in total the bridge required 100.5t of steelwork.

"We did a trial erection at our yard and this helped when it actually came to the real erection process," Mr Powlesland explains. "Knowing everything was going to fit exactly allowed for quicker erection programmes and most of the smaller bridges, like Middleton Road, were typically erected in one or two days."

***The Regent's Canal crossing is believed to be the first tied arch bridge ever used on a railway.***

South of Middleton, Rowecord erected new bridges over Haggerston Road, Arbutus Street and Lee Street, all close to the soon to-be-built Haggerston Station. Further south comes the Dunston Street bridge and then the canal crossing. Between the canal and the Union Walk site, Rowecord erected structures over How Street, Pearson Street and Cremer Street, which are 13.9m, 14.1m and 12.5m long respectively.

Summing up, Mr Powlesland says contracts with this many bridges don't come along very often and there was the potential for a number of hiccups. However, by working in close cooperation with Taylor Woodrow, all the structures went up in the alloted time. "Without any hitches which was pleasing in such a congested area," he says.

# Completing the hillside challenge

*Top: Circular roof lights are a feature of two blocks.*
*Above: The completed school will blend into the hillside.*

*Built on a steep Bristol hillside, the Redland Green School is a striking, innovative and environmentally sensitive educational establishment.*

When Bristol City Council gave the go-ahead for the construction of its new school at Redland Green, one of the main objectives was that it would blend into the surrounding hillside.

While the need for the school was never in doubt, many local residents had voiced their concerns that the structure, sitting on a green site once occupied by playing fields, would look a little obtrusive.

Architects and structural engineers BDP came up with a design, whereby the school, which juts out of the hillside, has been designed into the sloping landscape.

The school has six blocks ranging from one to four storeys, and main contractor Cowlin Construction has had to build to 17 different floor levels to compensate for the gradient.

To emphasis the school's green credentials, the three blocks on the northern side of the development will be linked together under one green roof. On top of a concrete roof slab much of the area will be covered in sedum, which will help to control water run off while ensuring some camouflage for the overall structure.

**The school has been designed into the sloping landscape**

The contractor says this area will be landscaped and used as an outdoor recreational zone surrounded by a safety barrier. The roof is also part of the school's water attenuation system. A ditch in the grounds will store excess water temporarily, allowing discharge rates to be balanced. This has been designed to protect properties and allotments, downhill of the school, from being affected by the school's run-off stream.

A 150m-long tunnel has been drilled from the base of the site underneath the allotments through which water will be discharged at a controlled rate. Much of the construction is a combination of concrete and steel, with the majority of the levels above ground floor and all of the roofs constructed with steel.

Running the length of the development and separating the six blocks in half is a 180m-long 'street' which is covered with an ETFE covering supported on steel trusses. Meanwhile, the three blocks to the south of the 'street' are essentially free-standing structures.

Barrie James, Project Manager for SIAC Tetbury Steel, says the main challenge for steel erection was the amount of curves within all of the blocks. Incorporating the buildings into a sloping site means they are curved on plan and section, as they gently snake down the hill. "This made for some interesting cantilevered steel roof detail design as

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Above: Gala Bingo, Newcastle - 50m span cellular rafters proved more economical than heavier UBs or plate girders.

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**FACT FILE**
**Redland Green School, Bristol**
**Main client:** Bristol City Council
**Architect:** BDP
**Structural engineer:** BDP
**Main contractor:** Cowlin Construction
**Steelwork contractor:** SIAC Tetbury Steel (formerly Bison Structures)
**Project value:** £30M
**Steel tonnage:** 520t

*Left: Blocks A, B and C. Bottom Left: No two sections of the steel roof are identical.*

*Above: The EFTE covered street. Below: The roof curves in two directions.*

there is no repetition of roof members," Mr James adds. "I doubt this part of the project could have been done in anything other than steel."

The three classroom buildings (which will be landscaped) on the north side are known as A, B and C. Block A, nearest the top of the hill, has two-storeys incorporating steel columns and a steel roof.

"Block B was an interesting structure for us," says Mr James. "This building contains a sports hall, which basically covers two-levels and required seven heavy trusses to give the open plan environment."

The trusses each weigh 11.5t and measure 18.3m long x 4m deep. The steelwork company says the only way of installing the trusses was to use a 120t capacity crane to lift each section into position. "We then in-filled all steel members with a smaller 50t capacity mobile crane while the truss was still being held by the other crane," Mr James explains. "We then connected all steelwork into connections which link into the adjacent blocks A and C."

***SIAC has installed two steel screens between the blocks to create an enclosed passageway and two steel bridges linking adjacent blocks***

The other three blocks to south of the 'street' vary in height from one level to four levels. Although the structures are free-standing, SIAC has installed two steel screens between the blocks to create an enclosed passageway and two steel bridges linking adjacent blocks.

The middle block of these three - E - also required two large heavy trusses to be installed. Resting on top of hollow section columns, the two members are each 21m-long and span over a canteen.

Rob Steele, Cowlin Site Manager states: "The job went very well due to the pre-start planning meetings, cooperation between SIAC Tetbury Steel and Cowlin's site team and weekly site coordination meetings involving other sub-contractors. Teamwork makes the site programme run very smoothly due to all site personnel pulling together."

Once the steel frame is completed the entire school will be clad in imported Canadian timber, which has been pre-dried to double the working lifespan. The wood is in two distinctive colours, with black on one elevation and light brown on the other. These hues are said to help the structure blend into the hillside, especially in the Autumn and Winter.

"Steel wise this isn't the biggest job we've ever done, but it's certainly one of the most complex," Mr James says. The structure does look very innovative and none of the local residents have complained about their view being spoilt.

*SIAC also supplied metal decking.*

# Fire protection of beams with web openings

*Dr Ian Simms, Manager of Fire Engineering at SCI, reports on recent developments affecting the design of fire protection for cellular beams.*

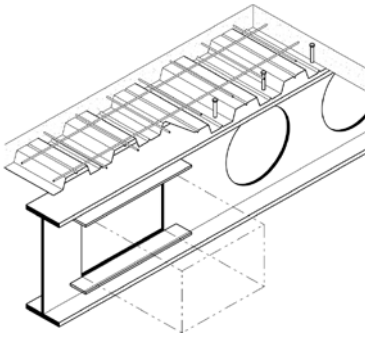


*Figure 1: Typical beam with web openings.*

## Introduction

Beams with web openings can include cellular beams fabricated from rolled sections or plate girders with circular or rectangular openings cut in the webs. Typical long span floor beams of this nature are designed to act compositely with the floor slab, as shown in Figure 1, greatly increasing their load carrying capabilities.

The use of asymmetric sections is also common, as this allows the weight of the beam to be reduced by removing steel from the top of the section where it is less effective.

## Structural Behaviour

The structural behaviour of beams with web openings is relatively complex and involves five main failure modes which are included in the design model for ULS design at room temperature and in fire conditions. The modes of failure are described briefly below, for a fuller explanation of the structural behaviour reference may be made to Lawson et al[1] or P068[2].

## Global bending & vertical shear

The global bending capacity of the beam is calculation at the centre of each opening and is based on a reduced cross sectional area. A composite beam with large openings tends to resist bending predominantly by tension in the bottom tee and compression in the concrete. The global bending capacity and the vertical shear capacity are rarely the critical modes of failure in cellular beams. In bending the utilisation of the bottom flange of the section will depend on the ability of the web posts to transfer horizontal shear. In beams with closely spaced openings the web post will often govern the load carrying capacity.

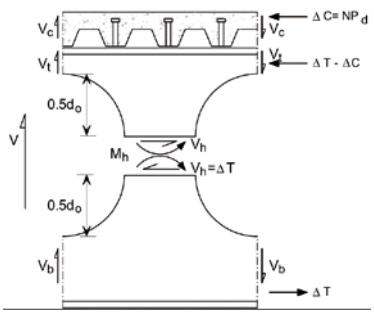



*Figure 2: Typical model of the forces and moments acting on the web post.*

The shear resistance of a cellular beam takes account of the contribution of the web and flange for rolled sections and the concrete slab. The precise distribution of shear between the top and bottom tees is determined from the analysis procedure and must be compatible with the vierendeel bending capacity of the tees.

## Web Post bending and horizontal shear

The model shown in Figure 2 shows the forces and moments acting on the web post between adjacent openings. Horizontal shear forces are developed in the web post in order to transfer the incremental tension force to the bottom tee. Web posts in asymmetric beams will also be subject to in-plane moments in order to maintain equilibrium between the top and bottom tees.

## Web Post Buckling

Due to the shear forces transferred across the web posts between openings failure can occur due to out of plane buckling, as illustrated by Figure 3. The tendency for the web post to buckle will depend on the width of the web post the height of the opening and the d/t ratio of the web.

*Figure 3: Web post buckling behaviour observed in a cellular beam test. Photograph courtesy Westok Ltd.*

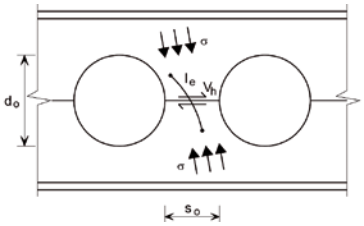


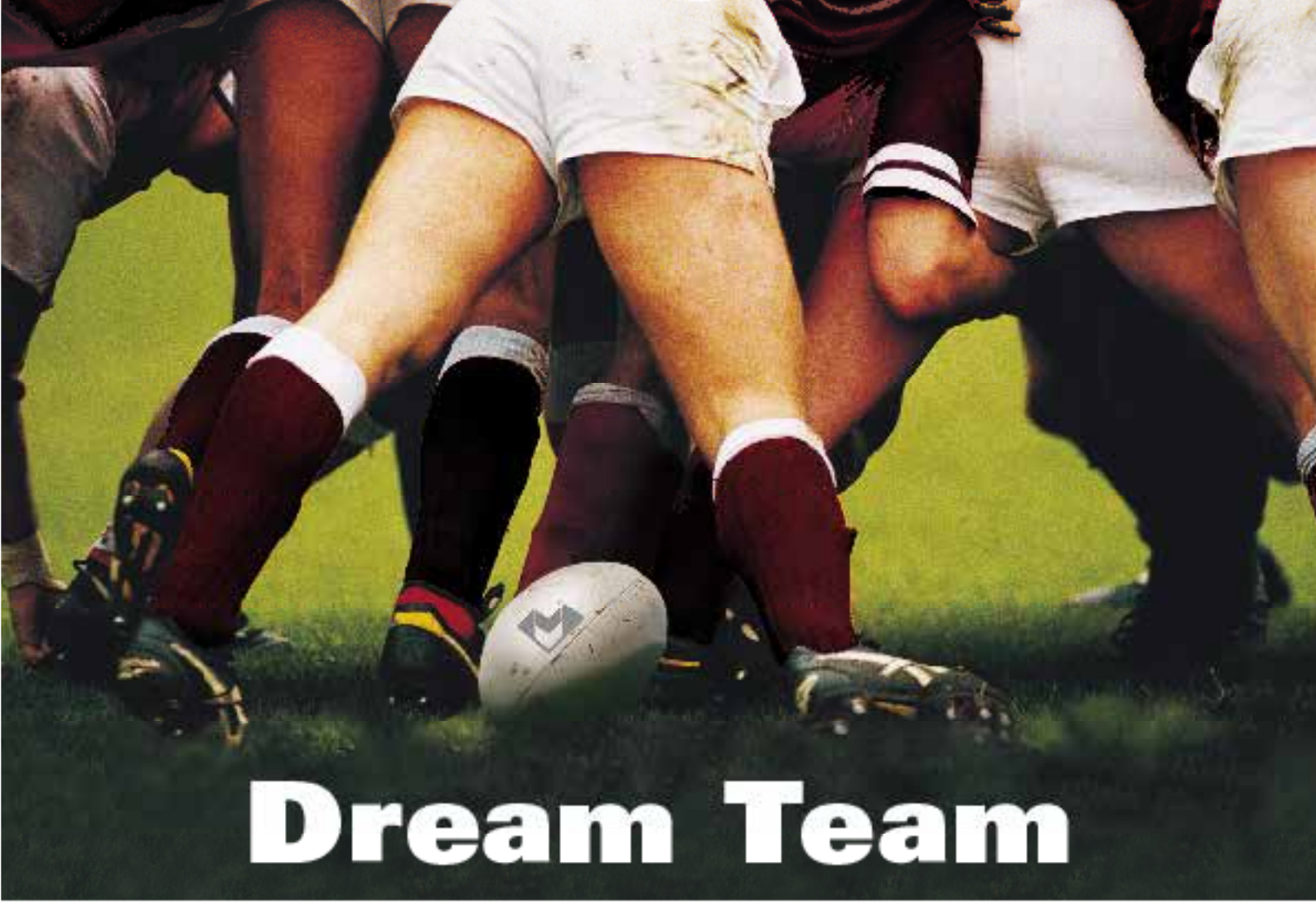

*Figure 4: Equivalent strut model.*

The web post buckling model currently preferred is based on the concept of an equivalent strut, as shown in Figure 4. This model has been calibrated against test results and finite element analysis for cold and fire design.

## Vierendeel bending

*Figure 5: Vierendeel bending of a stiffened rectangular opening.*

Vierendeel bending occurs due to the transfer of shear forces across an opening, which results in the development of local moments in the top and bottom tees. The bending resistance of the top tee can be based on the composite cross section where appropriate. When calculating these local



# Dream Team

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steel projects

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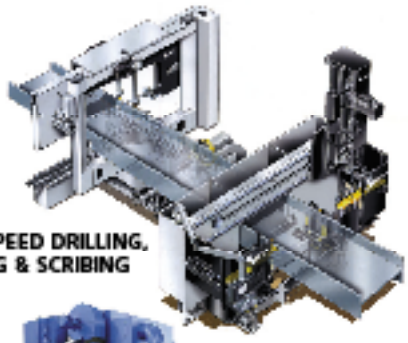

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bending resistances the moment capacity will be reduced to account for the presents of axial forces and shear due to global bending behaviour. Figure 5 shows vierendeel bending of a stiffened rectangular opening.

### Fire conditions

A similar structural model is adopted for fire design taking into account the variation of the material properties with temperature. The temperature distribution for cellular beams with various forms of fire protection needs to be determined from fire testing. The structural behaviour of the cellular beam may differ in fire conditions compared to room temperature conditions. The mode of failure observed in fire may be different to that observed for room temperature design. The principle difference will be the buckling behaviour of the web posts which is influenced by the variation of yield strength and elastic modulus with temperature. Figure 6 shows the variation of yield stress & elastic modulus with temperature. The greater reduction in elastic modulus with temperature compared to yield strength means that the buckling behaviour can become more significant to structural performance as the temperature of the member increases.

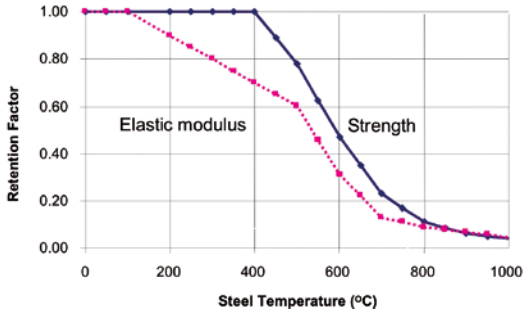



*Figure 6: Relative values of material properties of steel with temperature.*

### Thermal distribution

For the fire limit state, the structural model must assume a temperature distribution on the beam cross section in order for the capacity of the section to be calculated. From observations of previous fire tests on beams, the non-perforated web will

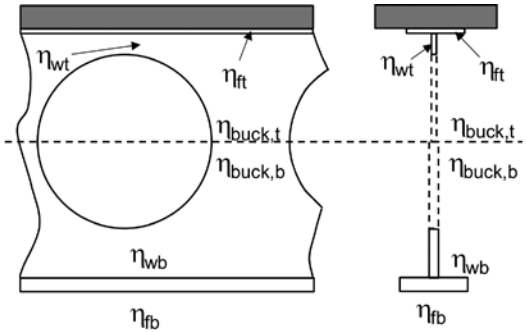



*Figure 7: Thermal distribution.*

generally be at a higher temperature relative to the flanges, due to the difference in thickness between these elements. However, the web posts between openings have been observed to experience a further increase in temperature relative to a non-perforated web, which accentuates the effect of the change of material properties with temperature.

Figure 7 shows the temperatures that must be determined for a cellular beam in order to allow the structural model to be applied to the fire design case. These temperatures are normally taken as relative values with respect to the bottom flange temperature, which is used as a reference point.

The temperature of the web post has been found to be dependant on the width of the web post and also the fire protection material used to protect the beam. Figure 8 shows the relationship between web post temperature and bottom flange temperature for a number of test specimens covering a range of web post widths and coating types. From these test results the generic relationship used in the RT1085[3] structural model has been derived and is shown as the solid line in Figure 8.

A similar relationship to that shown in Figure 8 has been observed for sprayed cementatious fire protection materials[4]. At present no data is available for board protection systems.

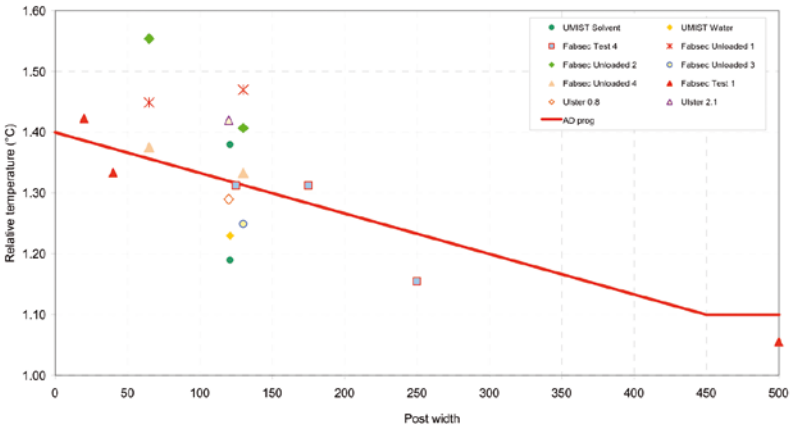



*Figure 8: Relationship between bottom flange temperature and webpost temperature.*

## Limiting Temperatures

As the mode of failure of cellular beams in fire conditions can change to web post buckling due to the combined effect of changing material properties and non-uniform temperatures, the limiting temperature of this type of section will depend on the performance of the fire protection material used to protect it. Some fire protection materials perform better than others in terms of their ability to limit the increase in web post temperature.

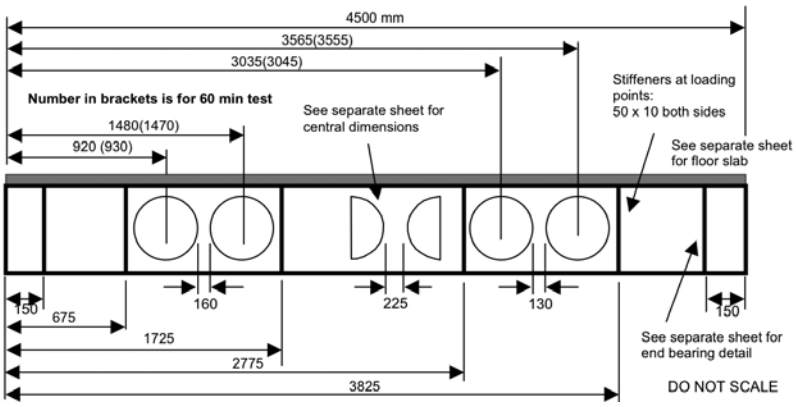



*Figure 9: Loaded test specimen.*


***References***

*1. Lawson et al, 'Design of composite asymmetric cellular beams and beams with large web openings', Journal of Constructional Steel Research, V62 N6, June 2006.*

*2. P355 'Design of Composite Beams with Large Openings for Services', SCI, 2007.*

*3. 'Guidance on the use of intumescent coatings for the fire protection of beams with web openings', RT1085 V3, 2006.*

*4. Large web openings for service integration in composite floors, Final Report for ECSC Research Contract 7210-PR-315, 2003*

*5. 'Fire Protection for structural steel in buildings', 4th edition, ASFP/SCI/FTSG, 2007.*


It is not adequate to base the fire protection requirements of cellular beams on room temperature structural analysis using the concept of load ratio, as is the case with plain beams. An elevated temperature structural analysis which takes account of temperature distribution and instability affects must be conducted for cellular beams.

## ASFP Testing Protocol

The purpose of the testing protocol is to determine suitable thermal data to enable a product specific version of the web post bottom flange temperature relationship to be determined. This can then be used as part of a structural analysis in order to determine appropriate limiting temperatures for design purposes.

The process requires that a conventional 'plain beam' assessment is available, for each product which is to be tested and evaluated for use on cellular beams. The 'plain beam' assessments provide a baseline dry film thickness onto which an appropriate enhancement for cellular beams is added, based on the limiting temperatures determined from structural analysis. For each fire resistance period covered, a multi-temperature analysis based on the 'plain beam' data must also be available for the intumescent coating system being evaluated.

The fire testing programme for cellular beams needs to consider a range of section geometries. Each fire test is carried out using five sections each fitted with thermocouples to measure temperature data. The specimens tested and the location of the instrumentation is standardized as part of the protocol. The basic section types are shown in Figure 9 and Figure 10. One loaded section is included in each test in order to permit the fire protection material to be evaluated over the range of deflections typically experienced by this type of section. The loaded section is fabricated from plate, and acts compositely with a slab cast on Z28 Holorib steel decking. The shear connection between the beam and the slab is achieved by two studs per trough, through deck welded to the top flange of the beam. The 120mm slab is constructed using C30 concrete and is reinforced with A142 mesh.

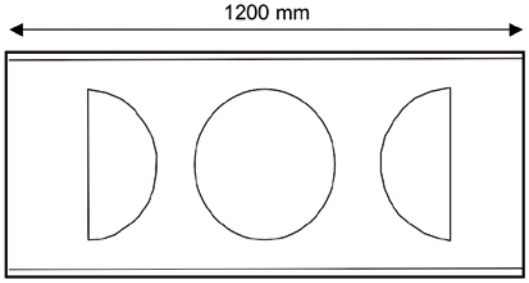



*Figure 10: Indicative specimens for the determination of thermal distributions.*

To gather the necessary thermal data four unloaded 1200mm sections are also included in the furnace, which enables a range of web post widths and section factors to be evaluated. These sections are fabricated from rolled sections or plates and contain two half openings and one full opening, as shown in Figure 10. The geometries of the sections used varies depending on the period of fire resistance to be evaluated. Standard sections are defined for 60, 90 and 120 minutes fire resistance. Figure 11 shows two of these indicative specimens located in the furnace, on either side of the loaded beam.

Full details of the testing protocol are given in the fourth edition of 'Fire protection for structural steel in buildings'[5].

*Figure 9: Internal view of the furnace prior to fire testing. Photograph courtesy Leigh's Paints.*

## Design Guidance

Generic design guide for composite cellular beams with circular openings exists in the public domain in the form of SCI report RT1085. The limiting temperature data given in this report, tabulated for a range of beam geometries, takes account of the temperature distribution in the cellular cross section and the web post instability effects. This report covers the design of beams with circular web openings but does not currently cover fabricated plate girders with rectangular openings. Intumescent manufacturers have also tested to the ASFP protocol and obtained a product specific version of RT1085, which contains more favourable limiting temperatures based on the actual performance of their particular intumescent coating.

Specialist fabricators Westok Ltd and Fabsec Ltd have free design software that includes fire design of Cellular beams and fabricated plate girders respectively. Fabsec provide a bespoke solution, FireBeam, for fabricated plate girders with circular or rectangular openings. Westok's Cellbeam software permits the design to calculate the limiting temperature for cellular beam designs which can then be fire protected using manufacturers data obtained from the ASFP protocol described above.

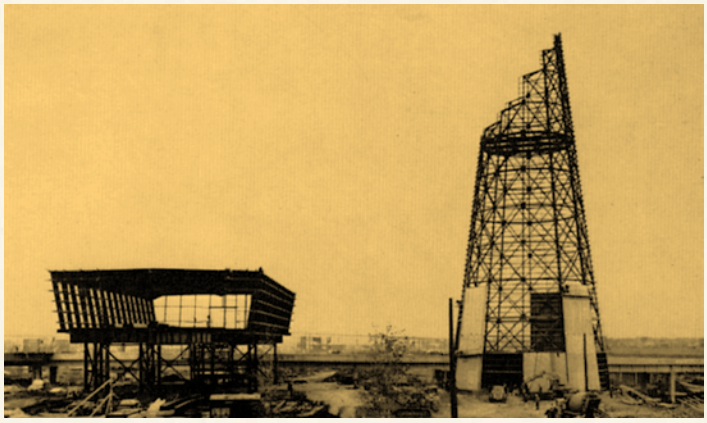
The structural designer needs to be aware that the fire protection of cellular beams is closely linked to the structural design. More information about the structural design will be required by the fire protection specialist than for plain beams.

# Digital computer reduces design time for the British Pavilion at Montreal


*Above and right: The British pavilion occupies three acres and uses nearly 1,000t of structural steelwork.*

*Below: The tower erected and the sheeting being added.*

*Bottom: The suspended platform on trial erection at the fabricator's works.*



The Universal and International Exhibition of 1967, known more colloquially as 'Expo 67' is part of Canada's Centennial Celebrations. The Exhibition is due to open in Montreal for six months from April 1967. The 1,007 acre site is spread over three main areas, the Ile Sainte Hélène, Ile Notre Dame and the Mackay Pier, all in the St. Lawrence River. It has been estimated that about 30 million people will visit the exhibition during its six month's run and that on peak days attendance will be in the region of 350,000.

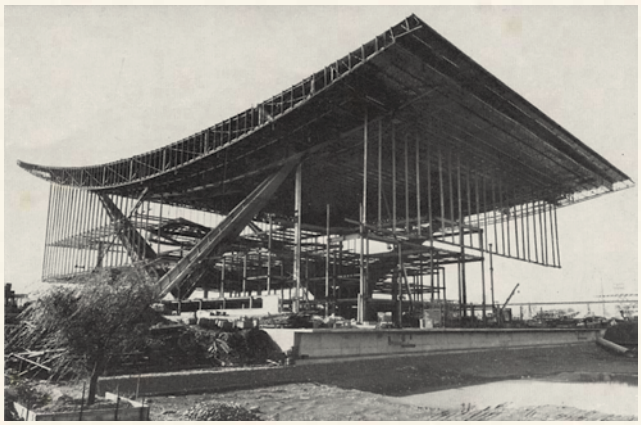
The British pavilion sits on a three-acre site on the Ile Notre Dame. Reminding visitors that the British are an island people, the cliff-like walls rise out of the water. The mass is big, with exhibition halls deeply cantilevered over moats and the site dominated by the tower.

The tower is a 202.5 ft tall 12-sided truncated tapered structure founded at a level of 50.00 O.D., the highest point being at a level of 252.5 O.D. The external width of the base is approximately 90ft reducing to about 54 ft at roof level, itself about 60ft below the highest point of the shell. The structure has a main internal floor at the level 73.00 O.D. and basically forms a hollow shell some 120ft in height up to the flat roof level. An intermediate platform between the main floor and the roof is suspended by rods from the sides of the structure. The steelwork is clad externally with asbestos cement sheeting and provision is made for an internal lining. The main floor is constructed of 4-in. thick concrete slab carried in metal trays supported by the structural framework.

It was decided that the most economical design could be developed in the time available only by the use of computer methods of analysis. Accordingly, arrangements were made with Prof. M. R. Horne of Manchester University to use the programme 'Lineal Analysis on Plane Space Frames' produced by his department to run on their computer. very approximate calculations were made for the steel framework and sizes selected therefrom. An intermediate bicycle wheel diaphagm was added to the tower frame at this stage, but once the computer analysed the preliminary sizes against the loading conditions, it was decided this was unecessary. The suspended platform was not finalised until a late stage in the design. The ring beam was made fully rigid and designed to take the torque from the platform – here again the use of the computer proved invaluable.

# Imaginative use of steelwork

*Top: Ile Notre Dame – Expo 67 takes shape. Above: The Indians of Canada's 100 ft high steel teepee. Left: The USA's geo-desic dome – 275 ft in diameter, constructed from steel, aluminium and clear plastics. Below: The USSR – a 100,000 ft² steel roof on 450 ft exposed vee-shaped steel supports.*



# AD 306
# Additional Moments in Braced Bays: 1

This is the first in a series of ADs that comment on the forces and moments to be designed for in beam-column-bracing connections in braced frames. *AD 304* pointed out that the nominal moments that are assumed from beam eccentricity cannot be ignored, even if forces in the bracing system have been calculated from a pin-jointed analysis. This AD covers common connection details and offers advice on how the connections can be designed.

The first common case is where the centre lines of the members are coincident, as shown in Figure 1.

Two models are commonly adopted for the design of the connections shown in Figure 1.

In the first model, the connection to the column is designed for a moment equal to *He*, where *e* is the vertical eccentricity from the beam centreline to the point the bracing centreline meets the column flange. Generally, this moment is dealt with by assuming that the point of rotation is the bottom flange of the beam. The vertical shear through the connection is the beam reaction, plus the contribution from the component of the bracing force. If this model is adopted, the nominal moment in the column is due only to the assumed eccentric reaction of the beam shear. There is no contribution from the bracing force to the nominal moment in the column.

An alternative model is to assume that the bracing is connected to the beam, and that the beam end connection remains truly pinned. In this case the end connection of the beam carries no moment, but must carry the beam shear and the vertical component of the bracing force. The column must be designed for the nominal moment from the assumed eccentric beam shear, plus an additional moment equal to $V \times D/2$ where $D$ is the column depth.

In Figure 2 the setting out point (sop) of the bracing has been shifted to the intersection of the beam centre line with the column face. This is very similar to the second model described above, in that the column must be designed for an additional moment equal to $V \times D/2$. It is also clear from Figure 2 that the vertical component of the bracing force adds to the shear in the beam from gravity loads, and this must be checked. The end connection is designed as a pin, to carry the vertical load from the bracing and the beam itself.

In Figure 3, the common and convenient situation of shifting the sop to the junction of beam and column flanges is shown. The main effect is the additional moment equal to $V \times D/2$ to be included in the column design. Additional shear and bending is produced in the beam, but this is generally not significant. The additional shear and moment is given below.

Additional shear, $Q = H \times B/L$
Additional bending moment, $M = H \times B/2$
Where $H$ is the horizontal component of the bracing force
$D$ is the depth of the column
$B$ is the depth of the beam
$L$ is the span of the beam

In summary, the additional moments that arise in braced bays due to the location of the setting out point must be added to the usual nominal moments from the beam end reactions and accounted for in the design of the column and its splices.

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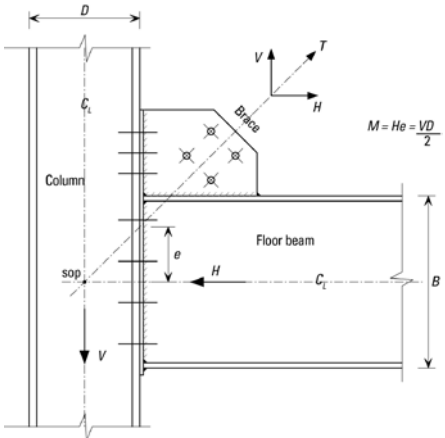


*Figure 1: Typical bracing type connection for simple construction.*

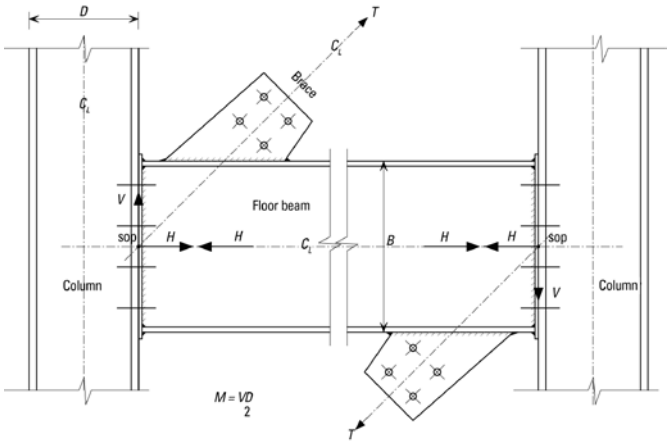


*Figure 2: Bracing connections made to the beam.*

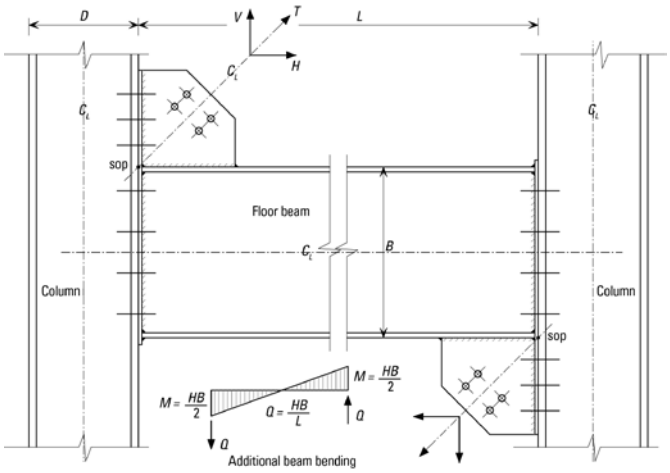


*Figure 3: Bracing set out to beam/column flange intersection.*

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**NEW BOOK**

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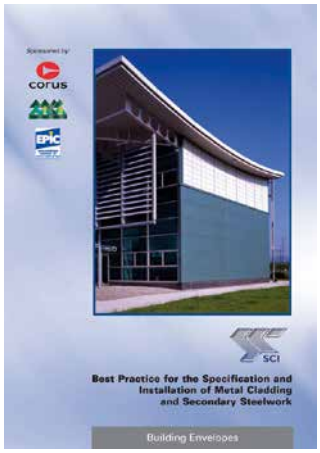


**'This publication will promote a greater understanding of the issues faced by the construction team and lead to better co-operation on site and in the design office'**

*Author: M D Heywood*
*ISBN 978-1-85942-171 0,*
*76 pp, A4 paperback*
*(includes colour photographs),*
*Dec 2006. Cat Ref: P346*

This new publication presents guidance to designers and contractors on the specification and installation of profiled metal cladding systems and the supporting purlins and side rails.

The guidance covers many aspects of cladding specification, including a brief description of the available systems and their components and an overview of the various performance criteria that should be considered by the specifier. Particular attention is paid to the structural performance of the cladding, since inadequate strength and stiffness not only undermine the safety of the building, but also impact on several of the other performance criteria such as airtightness and durability. Guidance is also included on the specification of the purlins and side rails with particular reference to the interaction between the building elements and the provision of lateral and torsional restraint. Sections on cladding and purlin installation provide an overview of the issues that need to be addressed in order to meet the performance criteria identified by the building designer.

Many of the issues covered have been brought to the attention of the SCI by industry representatives, whose advice and knowledge is the foundation for the guidance presented in the publication. The aim of the guidance is to promote good practice across the industry, leading to improvements in Health and Safety, efficiency and building envelope performance.

Although written with site practitioners in mind, much of the guidance should also be useful to architects and structural engineers involved in the specification of the building envelope and supporting structure.

*PRICES: Non-member £50, Member £25 (plus P&P)*



## New and Revised Codes and Standards

(from BSI Updates November 2006)

### BRITISH STANDARDS

**BS 5400:-**
Steel, concrete and composite bridges
**BS 5400-2:2006**
Specification for loads
*Supersedes BS 5400-2:1978*

### BS EN PUBLICATIONS

*The following are British Standard implementations of the English language versions of European Standards (ENs). BSI has an obligation to publish all ENs and to withdraw any conflicting British Standards or parts of British Standard. This has led to a series of standards, BS ENs using the EN number.*

***Note:** The date referenced in the identifier is the date of the European standard.*

**BS EN 1991:-**
Eurocode 1: Actions on structures
**BS EN 1991-1-7:2006**
General actions. Accidental actions
*No current standard is superseded*
**BS EN 1991-3:2006**
Actions induced by cranes and machines
*No current standard is superseded*

**BS EN 1998:-**
Eurocode 8: Design of structures for earthquake resistance
**BS EN 1998- 4:2006**
Silos, tanks and pipelines
*Supersedes DD ENV 1998-4:1999*

**BS EN 10268:2006**
Cold rolled steel flat products with high yield strength for cold forming. Technical delivery conditions
*Supersedes BS EN 10268:1999*

**BS EN 14889:-**
Fibres for concrete
**BS EN 14889-1:2006**
Steel fibres. Definitions, specifications and conformity
*No current standard is superseded*

### AMENDMENTS TO BRITISH STANDARDS

**BS EN 1993:-**
Eurocode 3: Design of steel structures
**BS EN 1993-1-1:2005**
General rules and rules for buildings
CORRIGENDUM 1 AMD 16568
**BS EN 1993-1-2:2005**
General rules. Structural fire design
CORRIGENDUM 2 AMD 16572
*Also incorporates Corrigendum 1*
**BS EN 1993-1-8:2005**
Design of joints
CORRIGENDUM 2 AMD 16571
*Also incorporates Corrigendum 1*
**BS EN 1993-1-9:2005**
Fatigue
CORRIGENDUM 2 AMD 16570
*Also incorporates Corrigendum 1*
**BS EN 1993-1-10:2005**
Material toughness and through-thickness properties
CORRIGENDUM 2 AMD 16569
*Also incorporates Corrigendum 1*

### NEW WORK STARTED

**BS EN 10029 (Revision)**
Hot rolled steel plates 3 mm thick or above. Tolerances on dimensions, shape and mass
*Will supersede BS EN 10029:1991*

### ISO PUBLICATIONS

**ISO 4952:2006**
(Edition 3)
Structural steels with improved atmospheric corrosion resistance
*Will not be implemented as a British Standard*

# The British Constructional Steelwork Association Ltd

**You can find email and website addresses for all these companies at www.steelconstruction.org**

BCSA is the national organisation for the steel construction industry. Details of BCSA membership and services can be obtained from Gillian Mitchell MBE, Deputy Directory General, BCSA, 4 Whitehall Court, London SW1A 2ES
Tel: 020 7839 8566 Email: gillian.mitchell@steelconstruction.org

## KEY

**Categories**
- **A** All forms of building steelwork
- **B*** Bridgework
- **C** Heavy industrial plant structures
- **D** High rise buildings
- **E** Large span portals
- **F** Medium/small span portals and medium rise buildings
- **H** Large span trusswork
- **J** Major tubular steelwork
- **K** Towers
- **L** Architectural metalwork
- **M** Frames for machinery, supports for conveyors, ladders and catwalks
- **N** Grandstands and stadia
- **S** Small fabrications

**Quality Assurance Certification**
- **Q1** Steel Construction Certification Scheme Ltd
- **Q2** BSI
- **Q3** Lloyd's
- **Q4** Other

**Classification** Contract Value
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- **8** Up to £200,000
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- **6** Up to £800,000
- **5** Up to £1,400,000
- **4** Up to £2,000,000
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- **2** Up to £4,000,000
- **1** Up to £6,000,000
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**Notes**
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